

LAB 2

CONSTRUCT A SIMPLE NETWORK



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Submission: an [ID_NAME_Lab02.pdf](#) file describes clearly how did you solve the problem

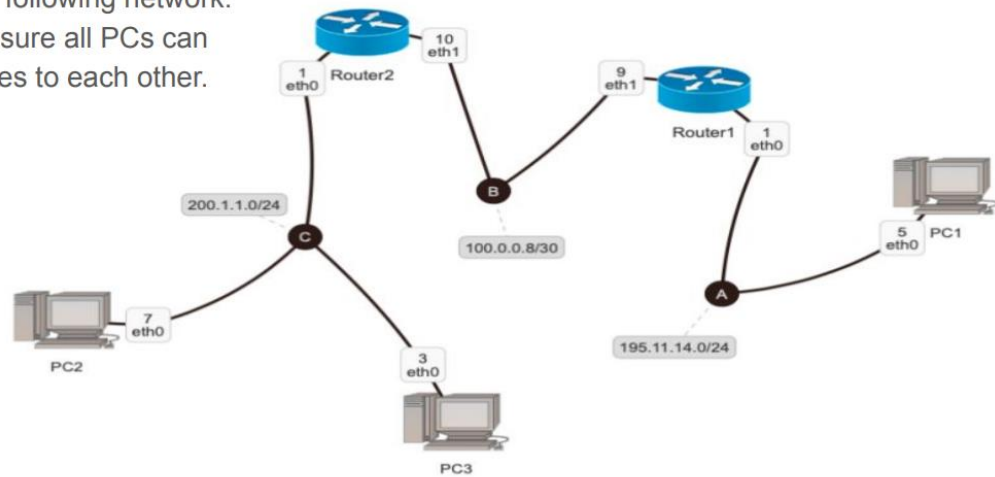
Exercise 0: change the directory to your home directory

Answer: \$cd

```
lnk@lnk: ~$ cd
lnk@lnk: ~$ |
```

Exercise 6:**Exercise 6**

Construct the following network.
Please make sure all PCs can send messages to each other.

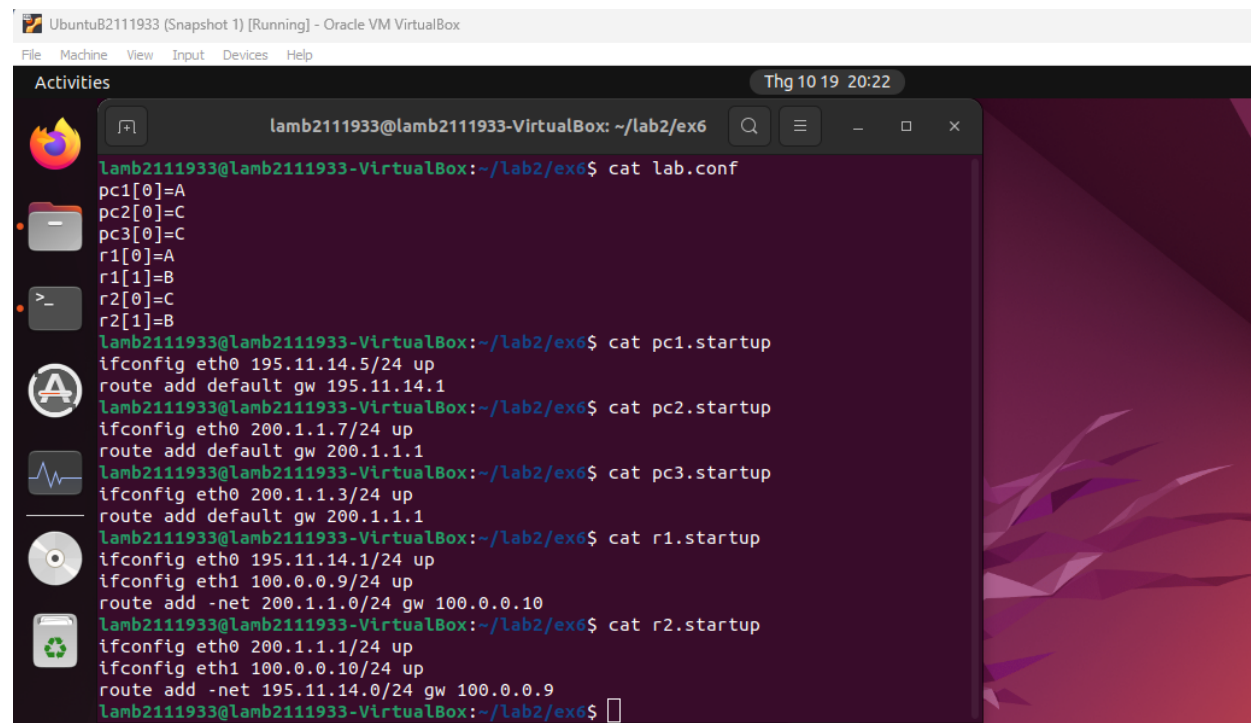


Create necessary files and folders

```
UbuntuB2111933 (Snapshot 1) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Thg 10 19 20:19
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex6
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex6$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── r1
├── r1.startup
├── r2
├── r2.startup
└── shared

6 directories, 6 files
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex6$
```

Show the contents of files



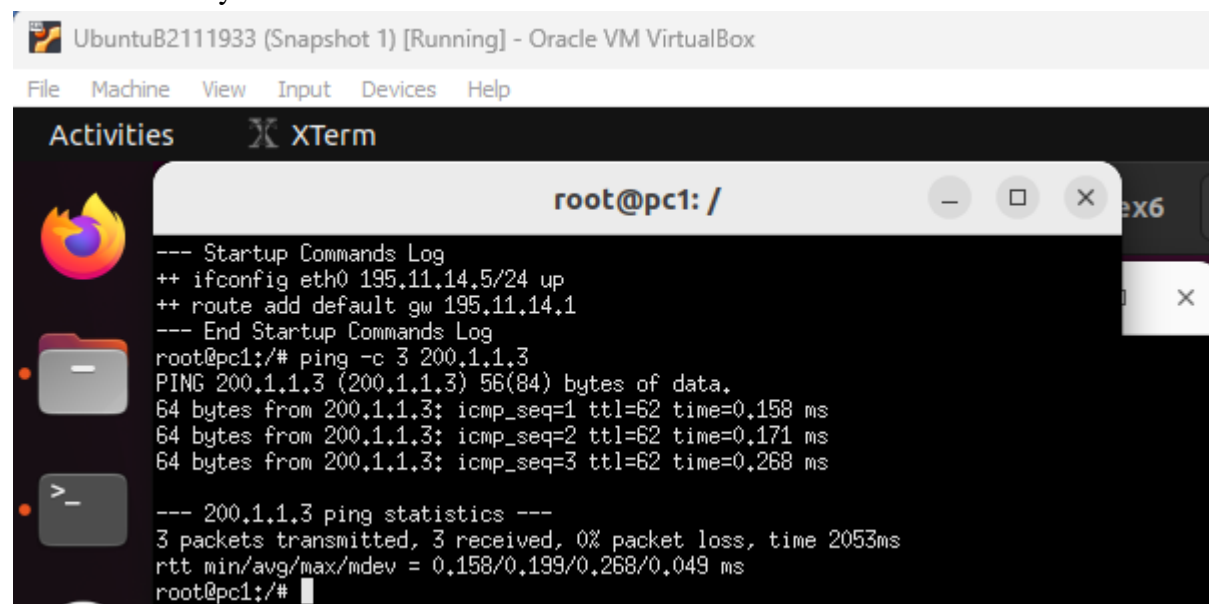
UbuntuB2111933 (Snapshot 1) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Thg 10 19 20:22

```
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex6
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex6$ cat lab.conf
pc1[0]=A
pc2[0]=C
pc3[0]=C
r1[0]=A
r1[1]=B
r2[0]=C
r2[1]=B
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex6$ cat pc1.startup
ifconfig eth0 195.11.14.5/24 up
route add default gw 195.11.14.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex6$ cat pc2.startup
ifconfig eth0 200.1.1.7/24 up
route add default gw 200.1.1.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex6$ cat pc3.startup
ifconfig eth0 200.1.1.3/24 up
route add default gw 200.1.1.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex6$ cat r1.startup
ifconfig eth0 195.11.14.1/24 up
ifconfig eth1 100.0.0.9/24 up
route add -net 200.1.1.0/24 gw 100.0.0.10
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex6$ cat r2.startup
ifconfig eth0 200.1.1.1/24 up
ifconfig eth1 100.0.0.10/24 up
route add -net 195.11.14.0/24 gw 100.0.0.9
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex6$
```

Test connectivity



UbuntuB2111933 (Snapshot 1) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm

```
root@pc1: /
--- Startup Commands Log
++ ifconfig eth0 195.11.14.5/24 up
++ route add default gw 195.11.14.1
--- End Startup Commands Log
root@pc1:/# ping -c 3 200.1.1.3
PING 200.1.1.3 (200.1.1.3) 56(84) bytes of data:
64 bytes from 200.1.1.3: icmp_seq=1 ttl=62 time=0.158 ms
64 bytes from 200.1.1.3: icmp_seq=2 ttl=62 time=0.171 ms
64 bytes from 200.1.1.3: icmp_seq=3 ttl=62 time=0.268 ms

--- 200.1.1.3 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2053ms
rtt min/avg/max/mdev = 0.158/0.199/0.268/0.049 ms
root@pc1:/#
```

UbuntuB2111933 (Snapshot 1) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm

root@pc2: /

```
--- Startup Commands Log
++ ifconfig eth0 200.1.1.7/24 up
++ route add default gw 200.1.1.1
--- End Startup Commands Log
root@pc2:/# ping -c 3 195.11.14.5
PING 195.11.14.5 (195.11.14.5) 56(84) bytes of data:
64 bytes from 195.11.14.5: icmp_seq=1 ttl=62 time=0.157 ms
64 bytes from 195.11.14.5: icmp_seq=2 ttl=62 time=0.080 ms
64 bytes from 195.11.14.5: icmp_seq=3 ttl=62 time=0.220 ms

--- 195.11.14.5 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2037ms
rtt min/avg/max/mdev = 0.080/0.152/0.220/0.057 ms
root@pc2:/#
```

UbuntuB2111933 (Snapshot 1) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm

root@r1: /

```
--- Startup Commands Log
++ ifconfig eth0 195.11.14.1/24 up
++ ifconfig eth1 100.0.0.9/24 up
++ route add -net 200.1.1.0/24 gw 100.0.0.10
--- End Startup Commands Log
root@r1:/# route -n
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
100.0.0.0      0.0.0.0         255.255.255.0   U      0      0      0 eth1
195.11.14.0    0.0.0.0         255.255.255.0   U      0      0      0 eth0
200.1.1.0      100.0.0.10      255.255.255.0   UG     0      0      0 eth1
root@r1:/#
```

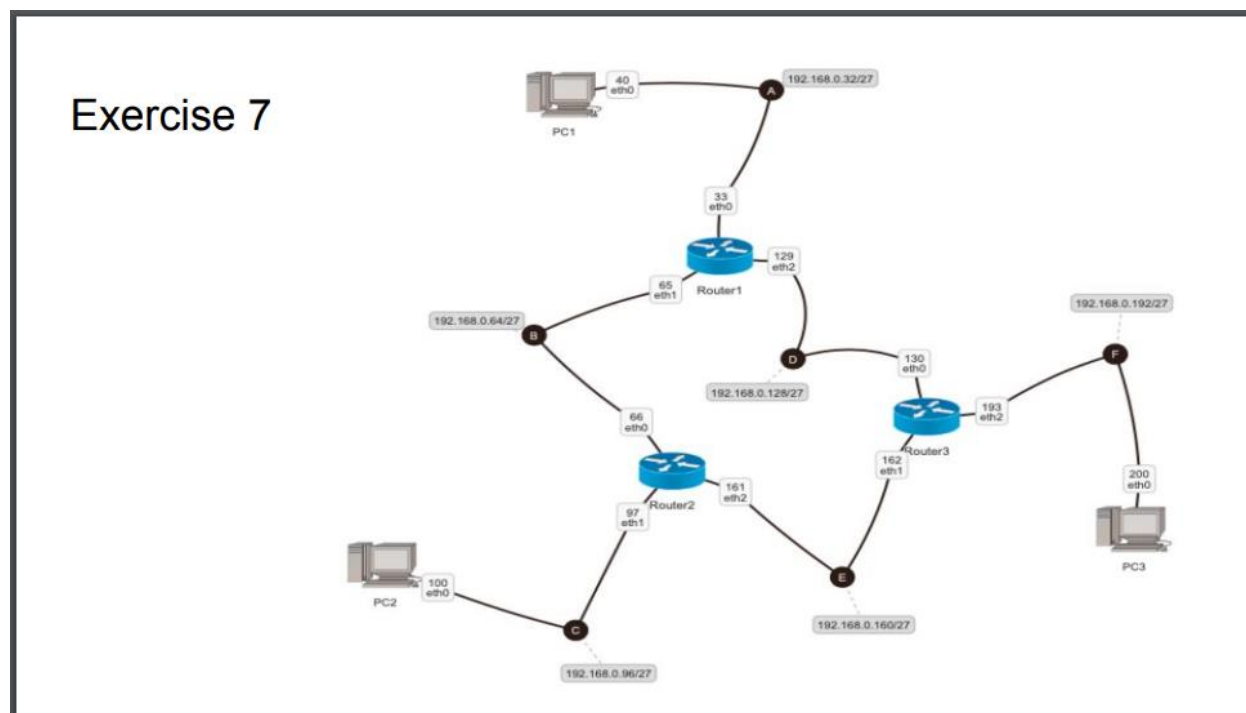
UbuntuB2111933 (Snapshot 1) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm

root@r2: /

```
--- Startup Commands Log
++ ifconfig eth0 200.1.1.1/24 up
++ ifconfig eth1 100.0.0.10/24 up
++ route add -net 195.11.14.0/24 gw 100.0.0.9
--- End Startup Commands Log
root@r2:/# route -n
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
100.0.0.0      0.0.0.0         255.255.255.0   U      0      0      0 eth1
195.11.14.0    100.0.0.9       255.255.255.0   UG     0      0      0 eth1
200.1.1.0      0.0.0.0         255.255.255.0   U      0      0      0 eth0
root@r2:/#
```

Exercise 7:

Create necessary folders and files

UbuntuB2111933 (Snapshot 1) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Thg 10 19 23:24

```
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex7
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex7$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── r1
├── r1.startup
├── r2
├── r2.startup
├── r3
├── r3.startup
└── shared

7 directories, 7 files
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex7$
```

The contents of files:

```

UbuntuB2111933 (Snapshot 1) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

Activities Terminal Thg 10 19 23:26

lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex7

lamb2111933@lamb2111933-VirtualBox:~/lab2/ex7$ cat pc1.startup
ifconfig eth0 192.168.0.40/27 up
route add default gw 192.168.0.33
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex7$ cat pc2.startup
ifconfig eth0 192.168.0.100/27 up
route add default gw 192.168.0.97
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex7$ cat pc3.startup
ifconfig eth0 192.168.0.200/27 up
route add default gw 192.168.0.193
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex7$ cat r1.startup
ifconfig eth0 192.168.0.33/27 up
ifconfig eth1 192.168.0.65/27 up
ifconfig eth2 192.168.0.129/27 up
route add -net 192.168.0.96/27 gw 192.168.0.66
route add -net 192.168.0.160/27 gw 192.168.0.66
route add -net 192.168.0.192/27 gw 192.168.0.130
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex7$ cat r2.startup
ifconfig eth0 192.168.0.66/27 up
ifconfig eth1 192.168.0.97/27 up
ifconfig eth2 192.168.0.161/27 up
route add -net 192.168.0.32/27 gw 192.168.0.65
route add -net 192.168.0.128/27 gw 192.168.0.162
route add -net 192.168.0.192/27 gw 192.168.0.162
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex7$ cat r3.startup
ifconfig eth0 192.168.0.130/27 up
ifconfig eth1 192.168.0.162/27 up
ifconfig eth2 192.168.0.193/27 up
route add -net 192.168.0.32/27 gw 192.168.0.129
route add -net 192.168.0.64/27 gw 192.168.0.161
route add -net 192.168.0.96/27 gw 192.168.0.161
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex7$

```

Test connectivity

```

UbuntuB2111933 (Snapshot 1) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

Activities XTerm Thg 10 19 23:30

root@pc1: / root@pc2: /

--- Startup Commands Log
++ ifconfig eth0 192.168.0.40/27 up
++ route add default gw 192.168.0.33
--- End Startup Commands Log
root@pc1:/# ping -c 3 192.168.0.100
PING 192.168.0.100 (192.168.0.100) 56(84) bytes of data:
64 bytes from 192.168.0.100: icmp_seq=1 ttl=62 time=0.133 ms
64 bytes from 192.168.0.100: icmp_seq=2 ttl=62 time=0.156 ms
64 bytes from 192.168.0.100: icmp_seq=3 ttl=62 time=0.079 ms

--- 192.168.0.100 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2037ms
rtt min/avg/max/mdev = 0.108/0.152/0.211/0.043
root@pc1:/#

--- Startup Commands Log
++ ifconfig eth0 192.168.0.100/27 up
++ route add default gw 192.168.0.97
--- End Startup Commands Log
root@pc2:/# ping -c 3 192.168.0.200
PING 192.168.0.200 (192.168.0.200) 56(84) bytes of data:
64 bytes from 192.168.0.200: icmp_seq=1 ttl=62 time=0.133 ms
64 bytes from 192.168.0.200: icmp_seq=2 ttl=62 time=0.156 ms
64 bytes from 192.168.0.200: icmp_seq=3 ttl=62 time=0.079 ms

--- 192.168.0.200 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2037ms
rtt min/avg/max/mdev = 0.079/0.122/0.156/0.032 ms
root@pc2:/#

```

UbuntuB2111933 (Snapshot 1) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm Thg 10 19 23:34

root@r1: /

```

--- Startup Commands Log
++ ifconfig eth0 192.168.0.33/27 up
++ ifconfig eth1 192.168.0.65/27 up
++ ifconfig eth2 192.168.0.129/27 up
++ route add -net 192.168.0.96/27 gw 192.168.0.66
++ route add -net 192.168.0.160/27 gw 192.168.0.66
++ route add -net 192.168.0.192/27 gw 192.168.0.130
--- End Startup Commands Log
root@r1:~# route -n
Kernel IP routing table
Destination Gateway Genmask Flags
192.168.0.32 0.0.0.0 255.255.255.224 U
192.168.0.64 0.0.0.0 255.255.255.224 U
192.168.0.96 192.168.0.66 255.255.255.224 UG
192.168.0.128 0.0.0.0 255.255.255.224 U
192.168.0.160 192.168.0.66 255.255.255.224 UG
192.168.0.192 192.168.0.130 255.255.255.224 UG
root@r1:~#

```

root@r2: /

```

--- Startup Commands Log
++ ifconfig eth0 192.168.0.65/27 up
++ ifconfig eth1 192.168.0.97/27 up
++ ifconfig eth2 192.168.0.161/27 up
++ route add -net 192.168.0.32/27 gw 192.168.0.65
++ route add -net 192.168.0.128/27 gw 192.168.0.162
++ route add -net 192.168.0.192/27 gw 192.168.0.162
--- End Startup Commands Log
root@r2:~# route -n
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
192.168.0.32 192.168.0.65 255.255.255.224 UG 0 0 0 eth0
192.168.0.64 0.0.0.0 255.255.255.224 U 0 0 0 eth0
192.168.0.96 0.0.0.0 255.255.255.224 U 0 0 0 eth1
192.168.0.128 192.168.0.162 255.255.255.224 UG 0 0 0 eth2
192.168.0.160 0.0.0.0 255.255.255.224 U 0 0 0 eth2
192.168.0.192 192.168.0.162 255.255.255.224 UG 0 0 0 eth2
root@r2:~#

```

root@r3: /

```

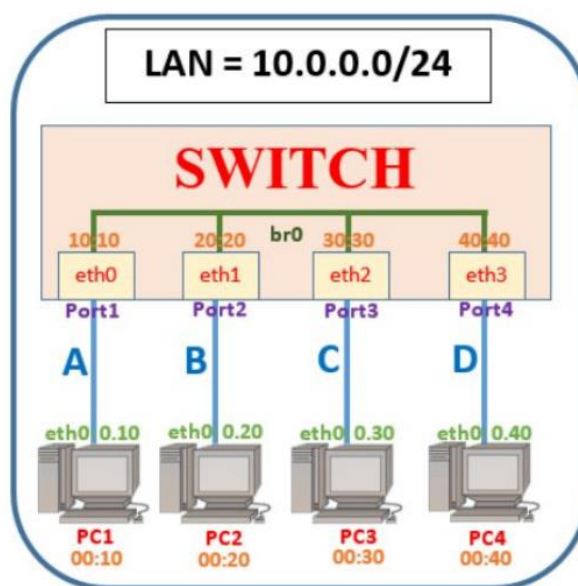
--- Startup Commands Log
++ ifconfig eth0 192.168.0.130/27 up
++ ifconfig eth1 192.168.0.162/27 up
++ ifconfig eth2 192.168.0.193/27 up
++ route add -net 192.168.0.32/27 gw 192.168.0.129
++ route add -net 192.168.0.64/27 gw 192.168.0.161
++ route add -net 192.168.0.96/27 gw 192.168.0.161
--- End Startup Commands Log
root@r3:~# route -n
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
192.168.0.32 192.168.0.129 255.255.255.224 UG 0 0 0 eth0
192.168.0.64 192.168.0.161 255.255.255.224 UG 0 0 0 eth1
192.168.0.96 192.168.0.161 255.255.255.224 UG 0 0 0 eth1
192.168.0.128 0.0.0.0 255.255.255.224 U 0 0 0 eth0
192.168.0.160 0.0.0.0 255.255.255.224 U 0 0 0 eth1
192.168.0.192 0.0.0.0 255.255.255.224 U 0 0 0 eth2
root@r3:~#

```

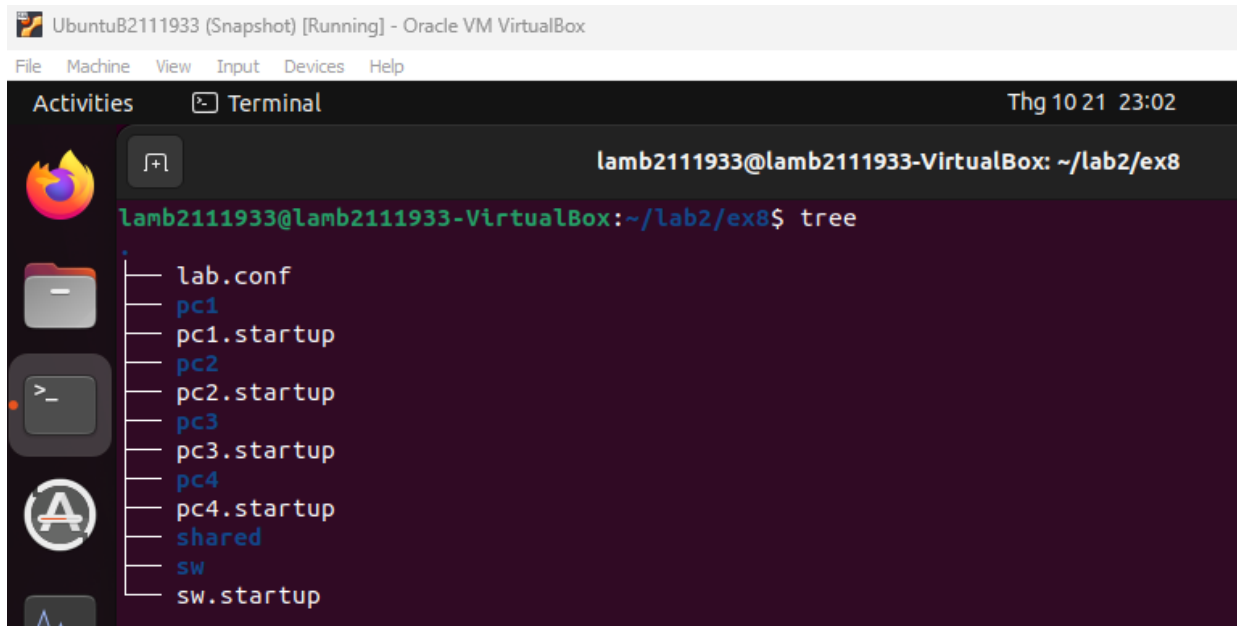
Exercise 8:

Exercise 8

1. Self-study “SWITCH”
2. Construct a LAN using a switch



Create necessary folders and files



UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

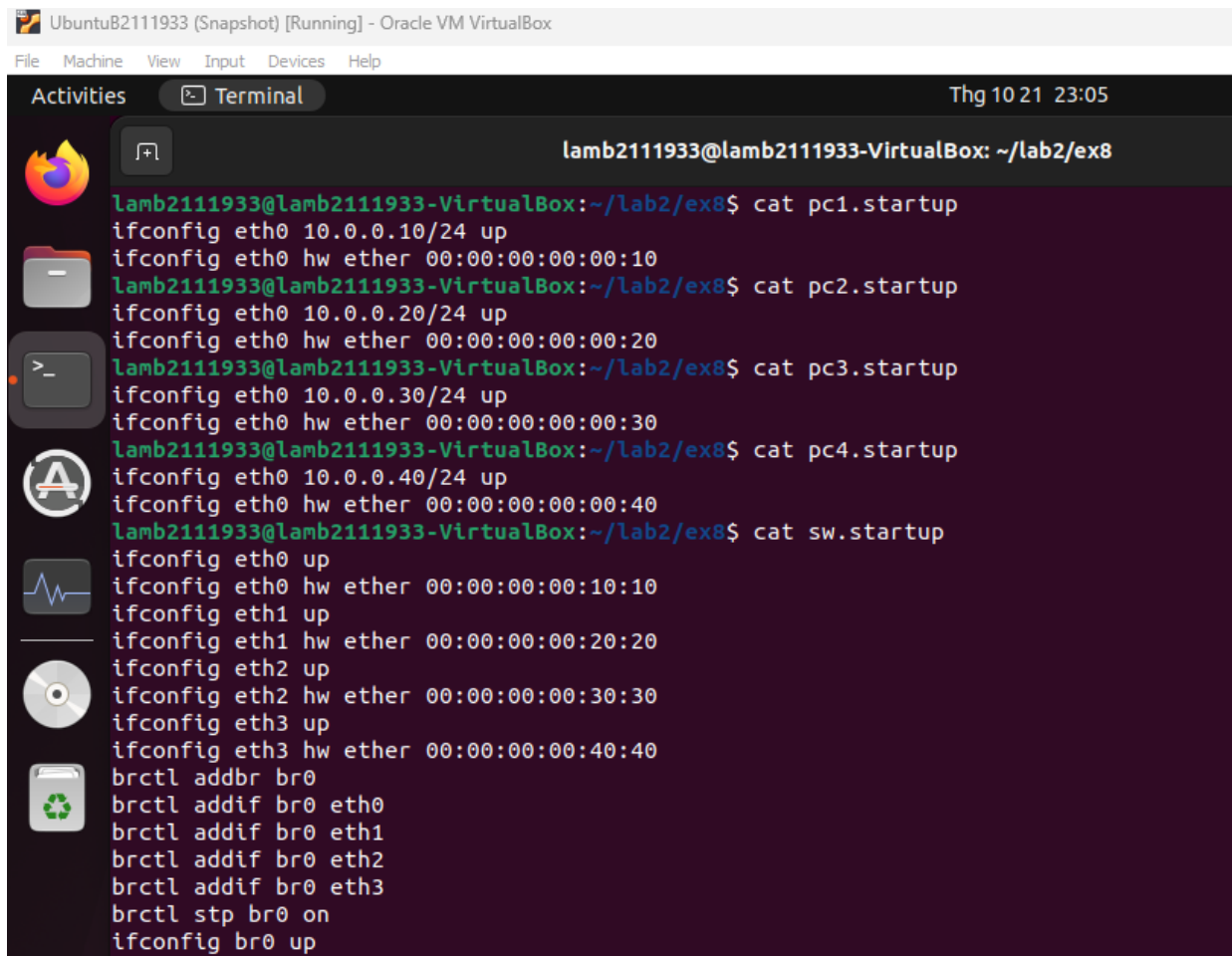
File Machine View Input Devices Help

Activities Terminal Thg 10 21 23:02

lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex8

```
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex8$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── pc4
├── pc4.startup
├── shared
├── sw
└── sw.startup
```

The contents of files:



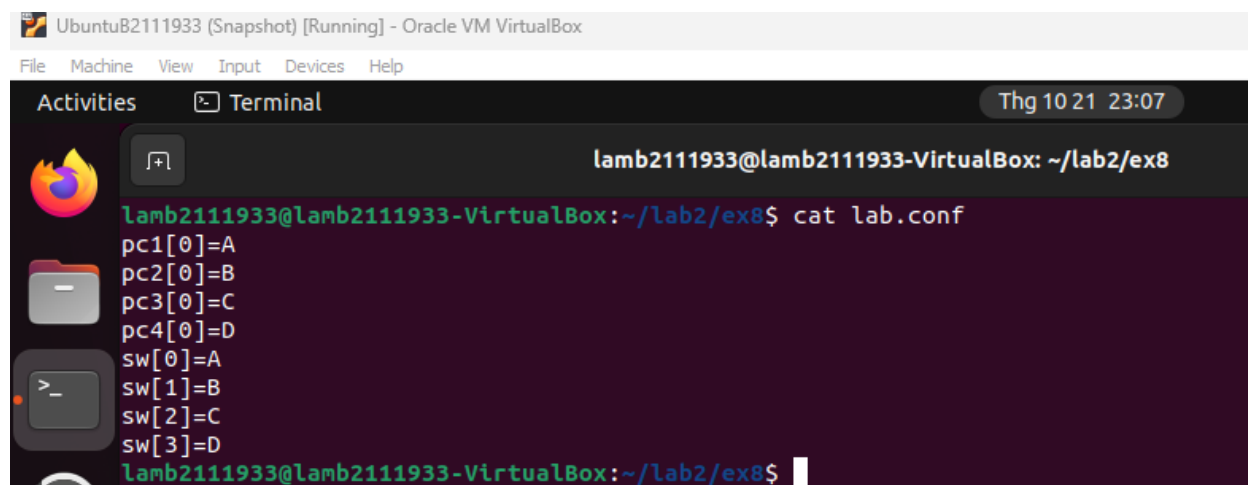
UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Thg 10 21 23:05

lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex8

```
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex8$ cat pc1.startup
ifconfig eth0 10.0.0.10/24 up
ifconfig eth0 hw ether 00:00:00:00:00:10
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex8$ cat pc2.startup
ifconfig eth0 10.0.0.20/24 up
ifconfig eth0 hw ether 00:00:00:00:00:20
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex8$ cat pc3.startup
ifconfig eth0 10.0.0.30/24 up
ifconfig eth0 hw ether 00:00:00:00:00:30
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex8$ cat pc4.startup
ifconfig eth0 10.0.0.40/24 up
ifconfig eth0 hw ether 00:00:00:00:00:40
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex8$ cat sw.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:00:10:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:00:20:20
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:00:30:30
ifconfig eth3 up
ifconfig eth3 hw ether 00:00:00:00:40:40
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl addif br0 eth3
brctl stp br0 on
ifconfig br0 up
```

UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

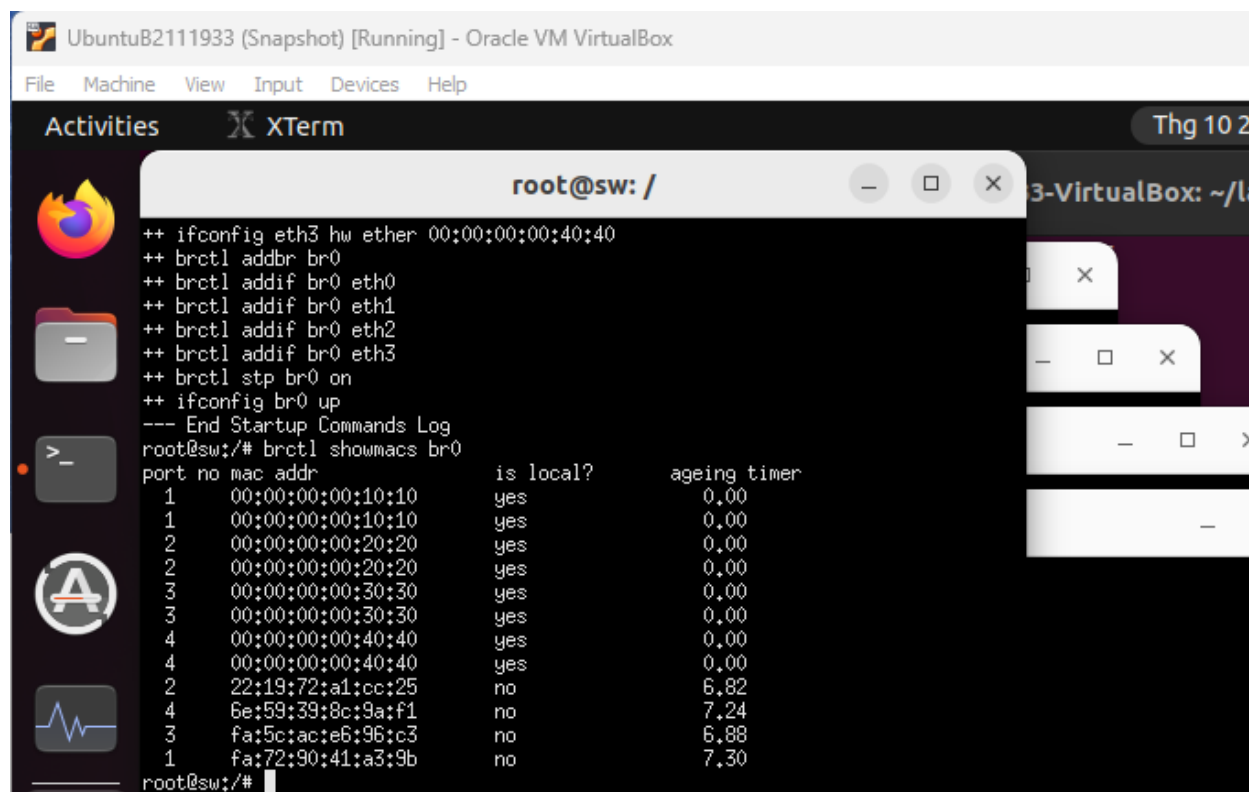
Activities Terminal Thg 10 21 23:07

lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex8

```
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex8$ cat lab.conf
pc1[0]=A
pc2[0]=B
pc3[0]=C
pc4[0]=D
sw[0]=A
sw[1]=B
sw[2]=C
sw[3]=D
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex8$
```

Start the lab

brctl showmacs br0



UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm Thg 10 21 23:07

root@sw: /

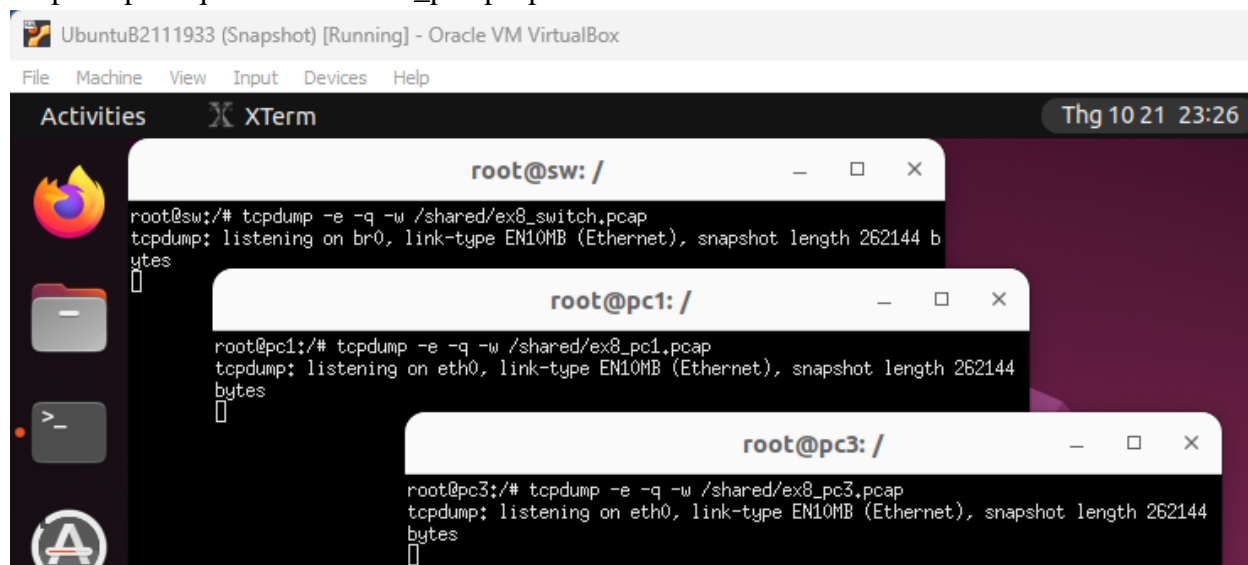
```
++ ifconfig eth3 hw ether 00:00:00:00:40:40
++ brctl addbr br0
++ brctl addif br0 eth0
++ brctl addif br0 eth1
++ brctl addif br0 eth2
++ brctl addif br0 eth3
++ brctl stp br0 on
++ ifconfig br0 up
--- End Startup Commands Log
root@sw:/# brctl showmacs br0
port no mac addr      is local?      ageing timer
1      00:00:00:00:10:10    yes             0.00
1      00:00:00:00:10:10    yes             0.00
2      00:00:00:00:20:20    yes             0.00
2      00:00:00:00:20:20    yes             0.00
3      00:00:00:00:30:30    yes             0.00
3      00:00:00:00:30:30    yes             0.00
4      00:00:00:00:40:40    yes             0.00
4      00:00:00:00:40:40    yes             0.00
2      22:19:72:a1:cc:25    no              6.82
4      6e:59:39:8c:9a:f1    no              7.24
3      fa:5c:act6:96:c3     no              6.88
1      fa:72:90:41:a3:9b    no              7.30
root@sw:/#
```

brctl showmacs br0 command is used to list all MAC address on br0

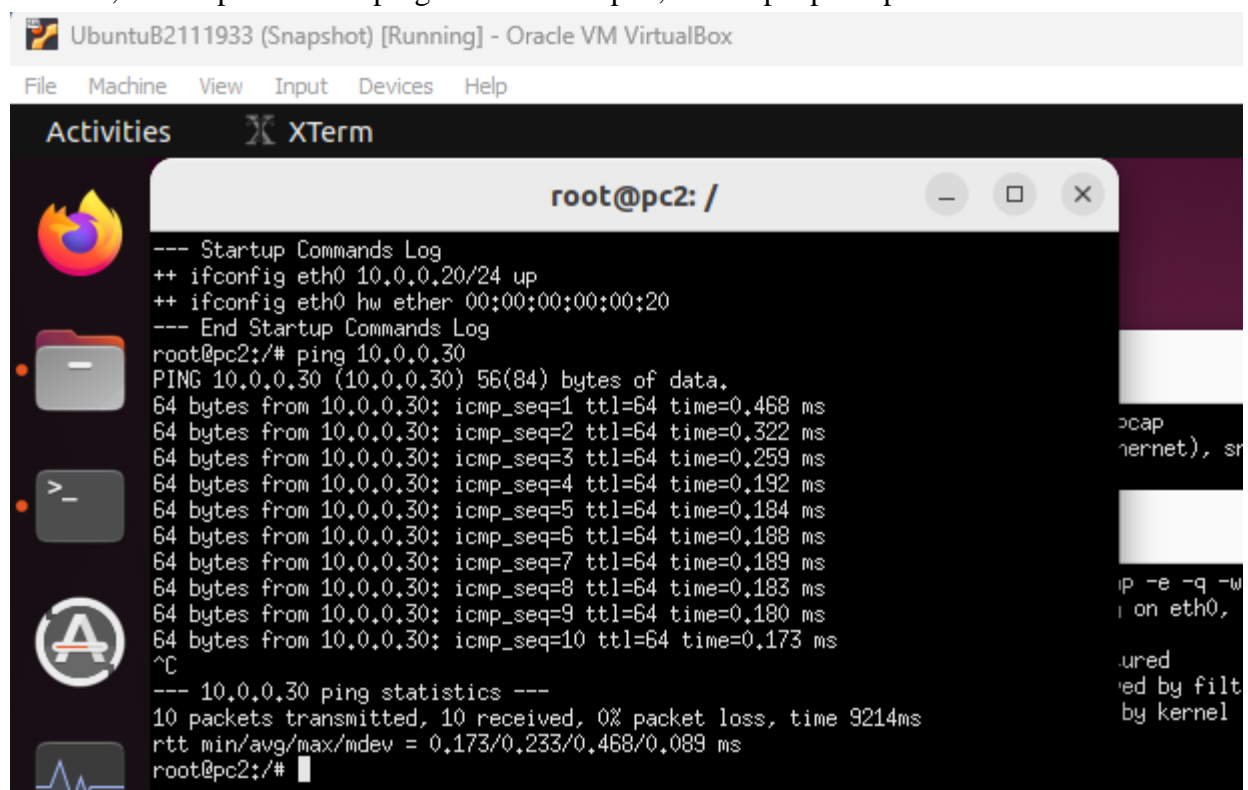
Exercise 8 (cont.)

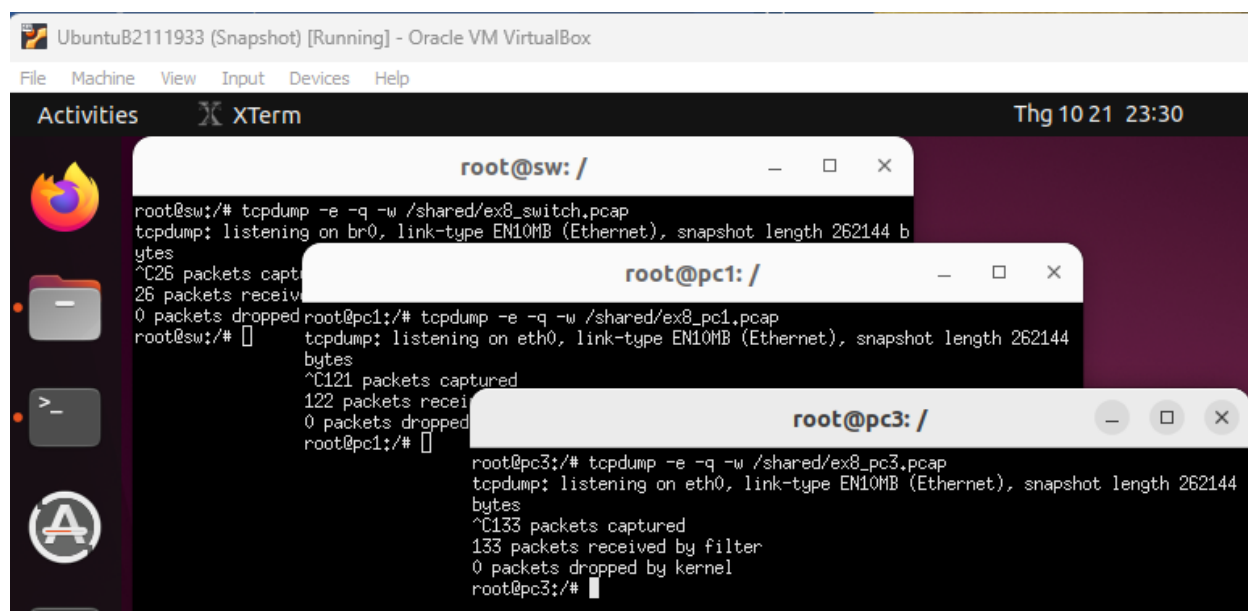
1. On the switch, pc1 and pc3, run the command:

- tcpdump -e -q -w /hostlab/ex8_switch.pcap
- tcpdump -e -q -w /hostlab/ex8_pc1.pcap
- tcpdump -e -q -w /hostlab/ex8_pc3.pcap

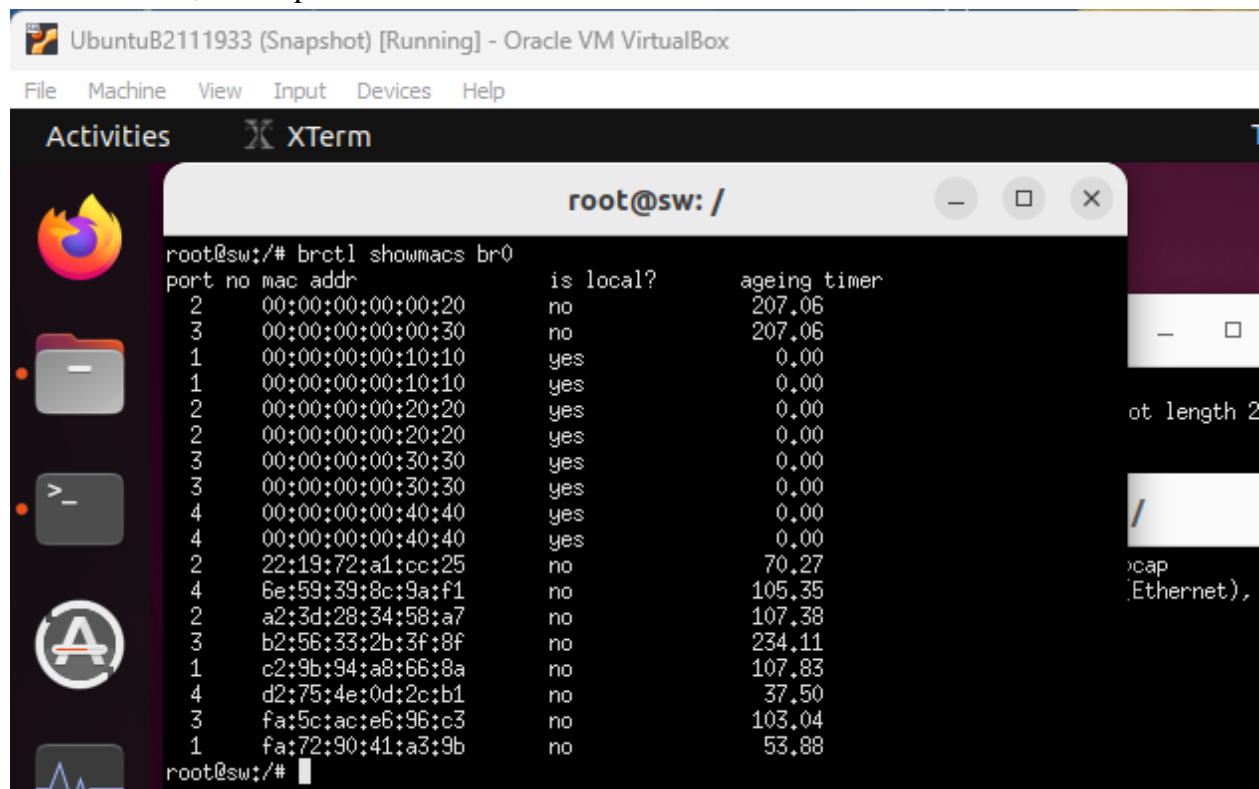


2. On pc2, send the message to pc3 using the command ping 10.0.0.30 , then wait for about 10 seconds, and stop all the ping command on pc2, and stop tcpdump commands on other devices.





3. On the switch check the contain of the Mac Lookup Table again using the command `brctl showmacs br0`, and explain the information lists in the Table



There are 2 mac addresses with 207.06 ageing timer. If there is no frame for ethernet bridge br0 within 207.06 seconds, they will be killed.

4. Use Wireshark to open ex8_switch.pcap, open the frame using ARP protocol with the source MAC address of 00:00:00:00:00:20, explain the contain in the frame

The screenshot shows the Wireshark interface with the file 'ex8_switch.pcap' open. The packet list pane displays the following packets:

No.	Time	Source	Destination	Protocol	Length
1	0.000000	fe80::b056:33ff:fe2...	ff02::2	ICMPv6	70
2	17.829093	00:00:00_00:00:20	Broadcast	ARP	42
3	17.829254	00:00:00_00:00:30	00:00:00_00:00:20	ARP	42
4	17.829299	10.0.0.20	10.0.0.30	ICMP	98
5	17.829355	10.0.0.30	10.0.0.20	ICMP	98
6	18.847353	10.0.0.20	10.0.0.30	ICMP	98

Frame 2 is selected, and the packet details pane shows the following information:

- Frame 2: 42 bytes on wire (336 bits), 42 bytes captured (336 bits)
- Ethernet II, Src: 00:00:00_00:00:20 (00:00:00:00:00:20), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
- Address Resolution Protocol (request)
 - Hardware type: Ethernet (1)
 - Protocol type: IPv4 (0x0800)
 - Hardware size: 6
 - Protocol size: 4
 - Opcode: request (1)
 - Sender MAC address: 00:00:00_00:00:20 (00:00:00:00:00:20)
 - Sender IP address: 10.0.0.20
 - Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
 - Target IP address: 10.0.0.30

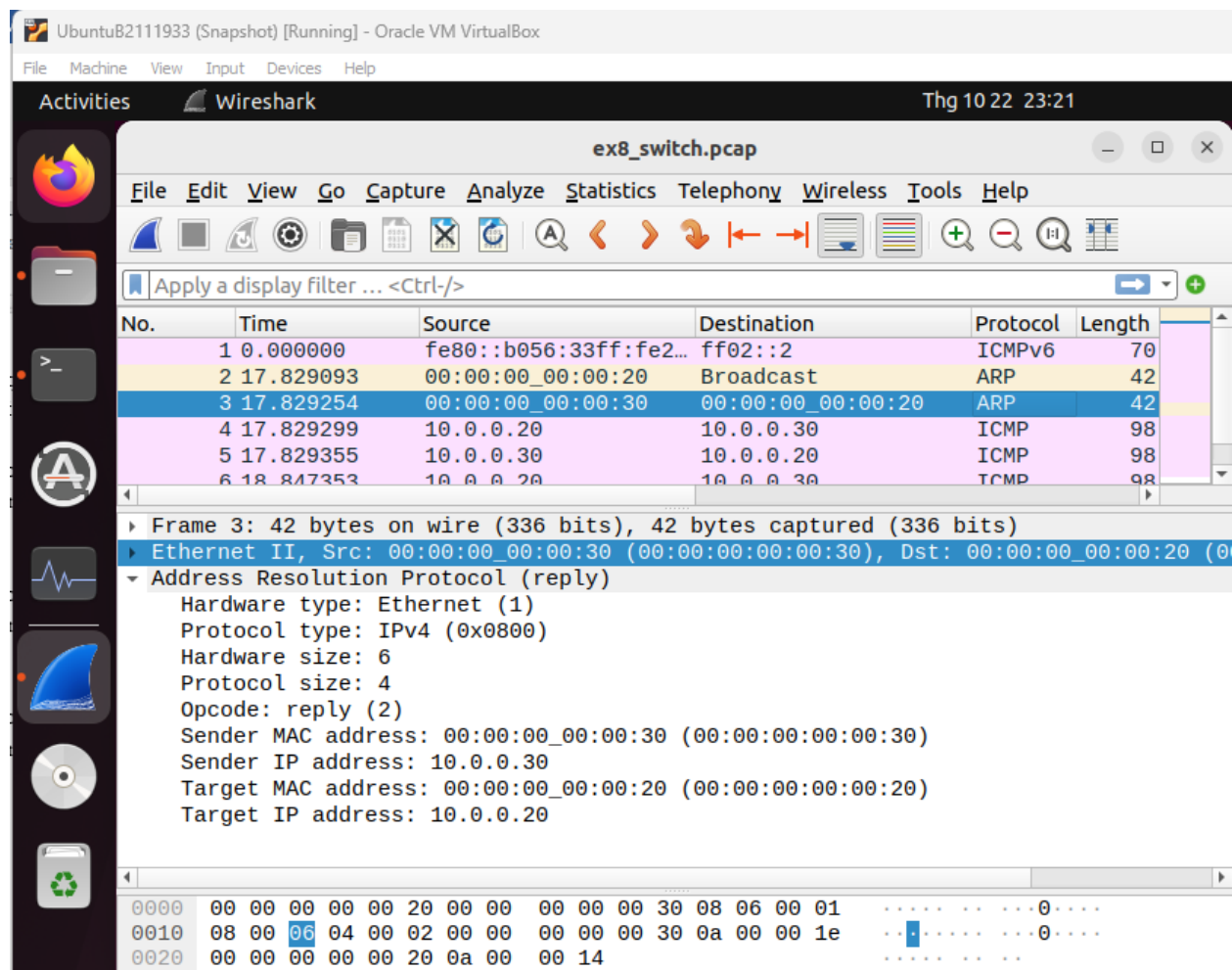
The packet bytes pane shows the raw data in hexadecimal and ASCII:

```

0000  ff ff ff ff ff ff 00 00 00 00 00 20 08 06 00 01  .....
0010  08 00 06 04 00 01 00 00 00 00 00 20 0a 00 00 14  .....
0020  00 00 00 00 00 00 0a 00 00 1e  .....
  
```

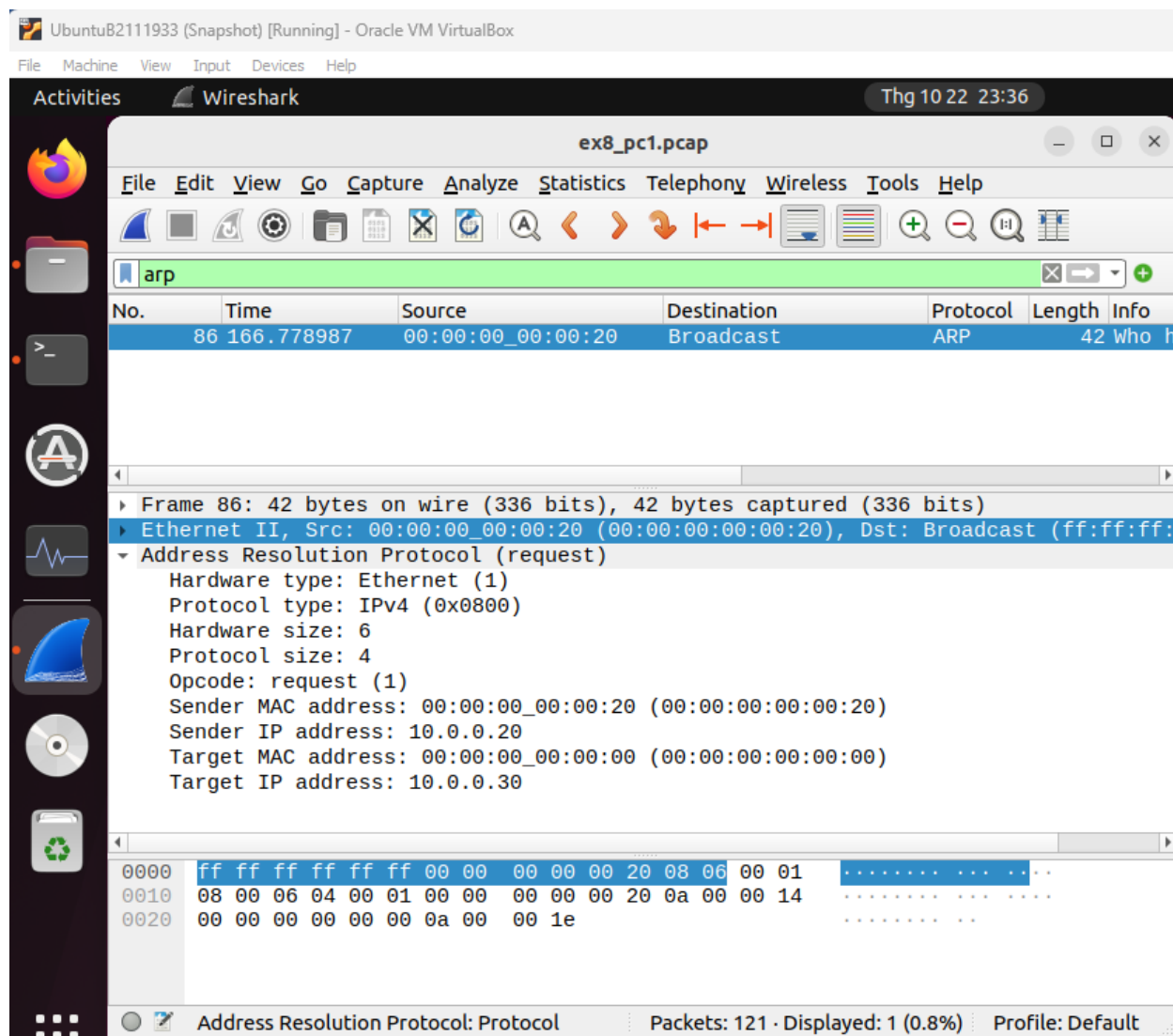
Frame 2 with the length is 42 bytes. This request frame (ARP) is sent from device with IP address 10.0.0.20 (00:00:00:00:00:20) to Broadcast(ff:ff:ff:ff:ff:ff) in order to find device 10.0.0.30

5. Use Wireshark to open ex8_switch.pcap, open the frame using ARP protocol with the source MAC address of 00:00:00:00:00:30, explain the contain in the frame



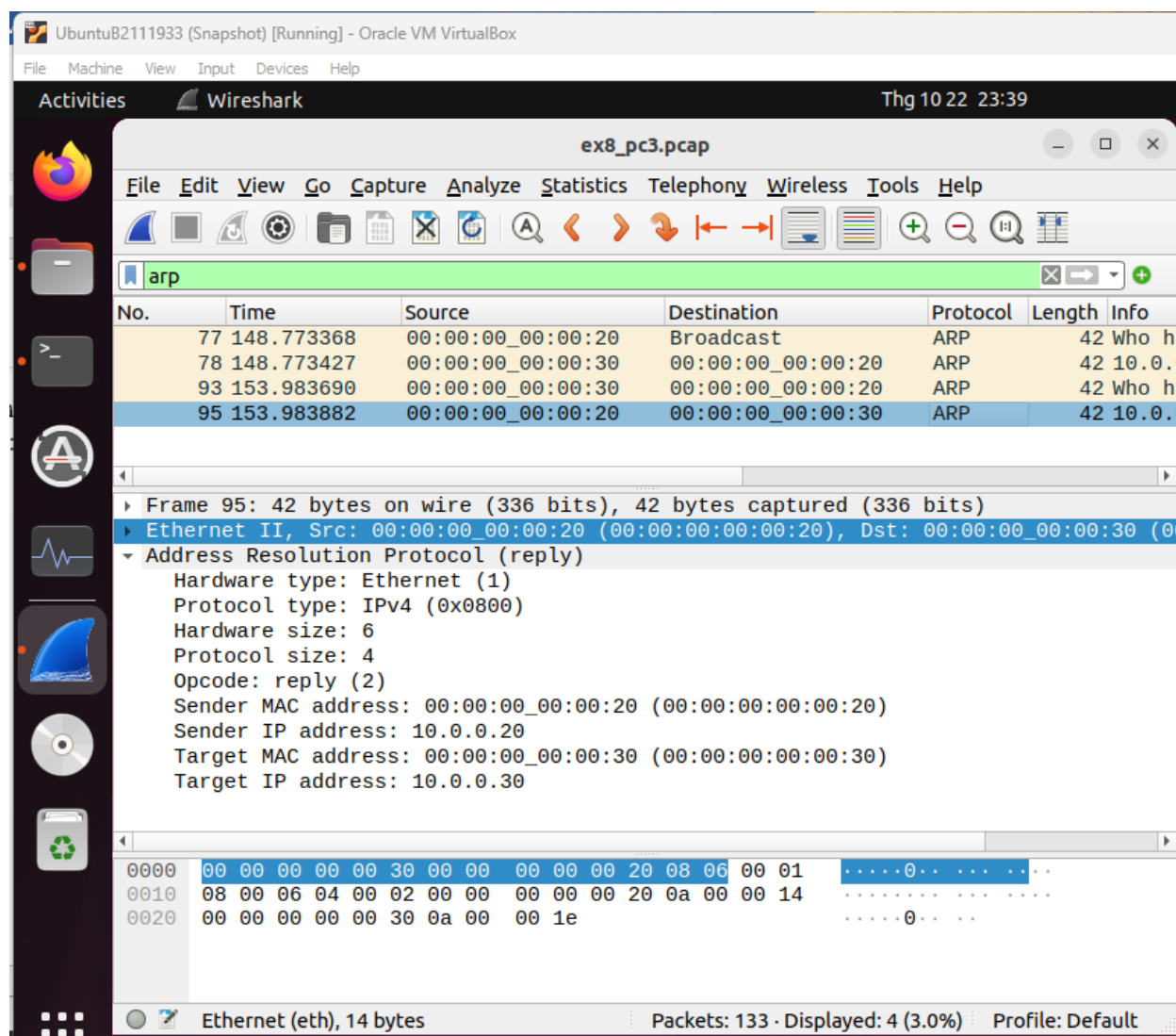
Frame 3 with the length is 42 bytes. This request frame (ARP) is sent from device with IP address 10.0.0.30 (00:00:00:00:00:30) to device with IP address 10.0.0.20 (00:00:00:00:00:20)

6. Use Wireshark to open pc1_switch.pcap, open the frame using ARP protocol with the source MAC address of 00:00:00:00:00:30, explain the contain in the frame



There's no “frame using ARP protocol with the source MAC address of 00:00:00:00:00:30”

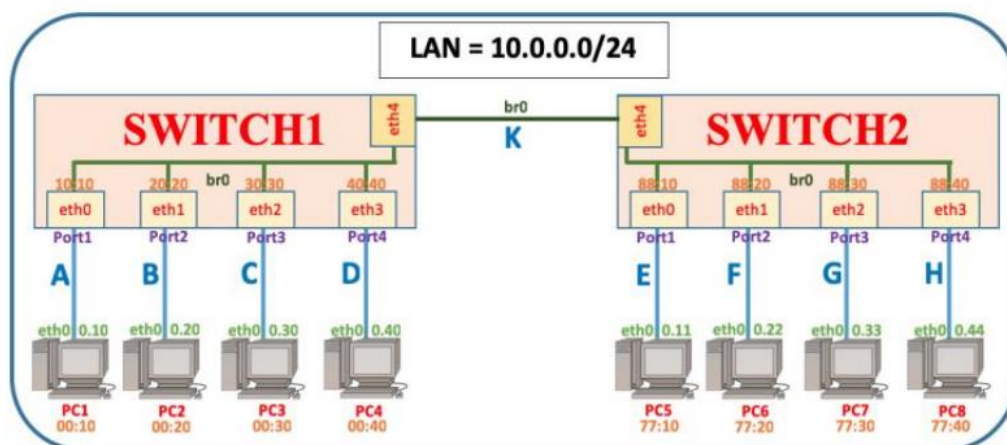
7. Use Wireshark to open pc3_switch.pcap, open the frame using ARP protocol with the source MAC address of 00:00:00:00:00:30, explain the contain in the frame



Frame 95 with the length is 42 bytes. This request frame (ARP) is sent from device with IP address 10.0.0.20 (00:00:00:00:00:20) to device with IP address 10.0.0.30 (00:00:00:00:00:30)

Exercise 9:**Exercise 9**

Construct the following network



Create necessary files and folders

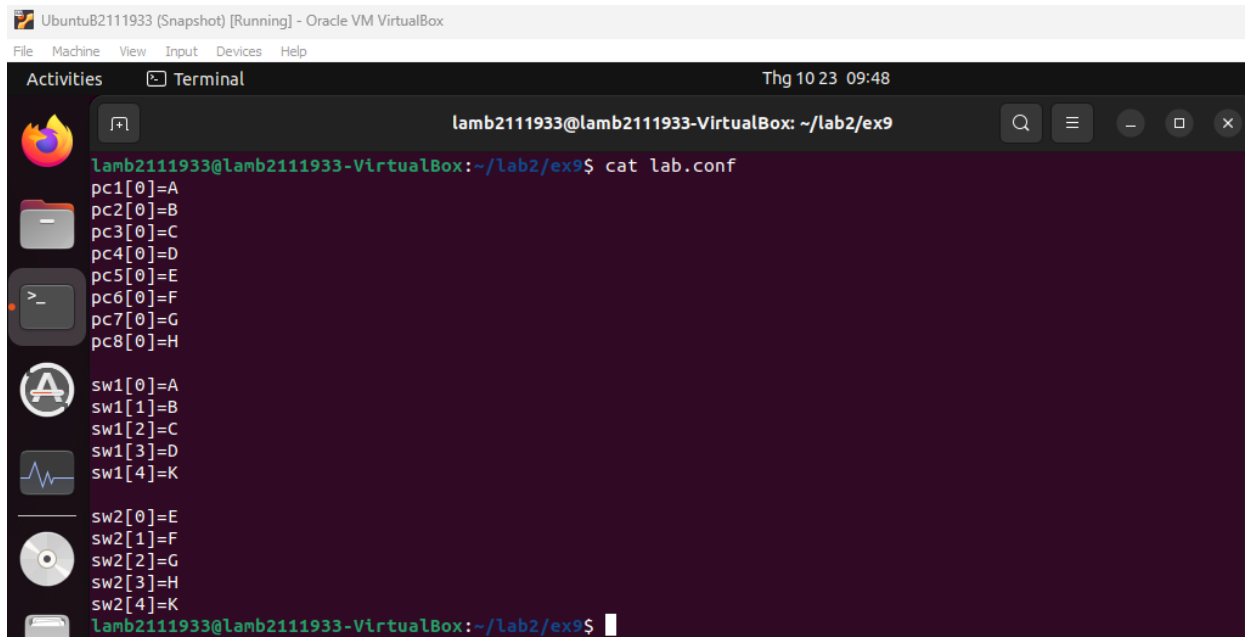
```
UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

Activities Terminal Thg 10 23 09:46
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex9

lamb2111933@lamb2111933-VirtualBox:~/lab2/ex9$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── pc4
├── pc4.startup
├── pc5
├── pc5.startup
├── pc6
├── pc6.startup
├── pc7
├── pc7.startup
├── pc8
├── pc8.startup
├── shared
├── sw1
├── sw1.startup
├── sw2
└── sw2.startup

11 directories, 11 files
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex9$
```

The contents of files:



UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

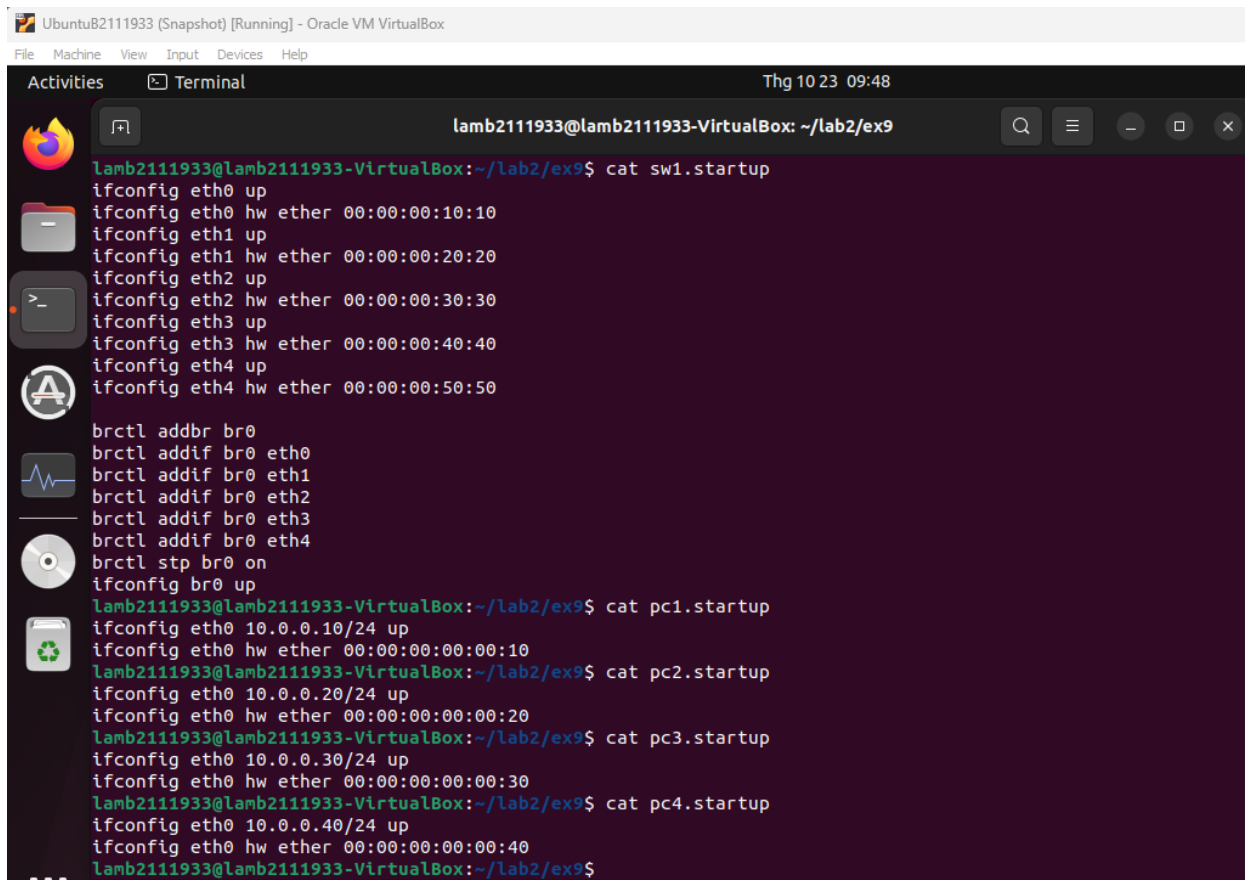
Activities Terminal Thg 10 23 09:48

lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex9

```
lamb2111933@lamb211933-VirtualBox:~/lab2/ex9$ cat lab.conf
pc1[0]=A
pc2[0]=B
pc3[0]=C
pc4[0]=D
pc5[0]=E
pc6[0]=F
pc7[0]=G
pc8[0]=H

sw1[0]=A
sw1[1]=B
sw1[2]=C
sw1[3]=D
sw1[4]=K

sw2[0]=E
sw2[1]=F
sw2[2]=G
sw2[3]=H
sw2[4]=K
lamb2111933@lamb211933-VirtualBox:~/lab2/ex9$
```



UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Thg 10 23 09:48

lamb2111933@lamb211933-VirtualBox: ~/lab2/ex9

```
lamb2111933@lamb211933-VirtualBox:~/lab2/ex9$ cat sw1.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:10:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:20:20
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:30:30
ifconfig eth3 up
ifconfig eth3 hw ether 00:00:00:40:40
ifconfig eth4 up
ifconfig eth4 hw ether 00:00:00:50:50

brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl addif br0 eth3
brctl addif br0 eth4
brctl stp br0 on
ifconfig br0 up
lamb2111933@lamb211933-VirtualBox:~/lab2/ex9$ cat pc1.startup
ifconfig eth0 10.0.0.10/24 up
ifconfig eth0 hw ether 00:00:00:00:00:10
lamb2111933@lamb211933-VirtualBox:~/lab2/ex9$ cat pc2.startup
ifconfig eth0 10.0.0.20/24 up
ifconfig eth0 hw ether 00:00:00:00:00:20
lamb2111933@lamb211933-VirtualBox:~/lab2/ex9$ cat pc3.startup
ifconfig eth0 10.0.0.30/24 up
ifconfig eth0 hw ether 00:00:00:00:00:30
lamb2111933@lamb211933-VirtualBox:~/lab2/ex9$ cat pc4.startup
ifconfig eth0 10.0.0.40/24 up
ifconfig eth0 hw ether 00:00:00:00:00:40
lamb2111933@lamb211933-VirtualBox:~/lab2/ex9$
```

UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Thg 10 23 09:49

lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex9

```
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex9$ cat sw2.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:88:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:88:20
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:88:30
ifconfig eth3 up
ifconfig eth3 hw ether 00:00:00:88:40
ifconfig eth4 up
ifconfig eth4 hw ether 00:00:00:88:50

brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl addif br0 eth3
brctl addif br0 eth4
brctl stp br0 on
ifconfig br0 up
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex9$ cat pc5.startup
ifconfig eth0 10.0.0.11/24 up
ifconfig eth0 hw ether 00:00:00:00:77:10
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex9$ cat pc6.startup
ifconfig eth0 10.0.0.22/24 up
ifconfig eth0 hw ether 00:00:00:00:77:20
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex9$ cat pc7.startup
ifconfig eth0 10.0.0.33/24 up
ifconfig eth0 hw ether 00:00:00:00:77:30
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex9$ cat pc8.startup
ifconfig eth0 10.0.0.44/24 up
ifconfig eth0 hw ether 00:00:00:00:77:40
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex9$
```

Start the lab and test connectivity

UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm Thg 10 23 09:58

root@pc8: /

```
--- Startup Commands Log
++ ifconfig eth0 10.0.0.44/24 up
++ ifconfig eth0 hw ether 00:00:00:00:77:40
--- End Startup Commands Log
root@pc8:/# ping -c 3 10.0.0.10
PING 10.0.0.10 (10.0.0.10) 56(84) bytes of data:
64 bytes from 10.0.0.10: icmp_seq=1 ttl=64 time=1004 ms
64 bytes from 10.0.0.10: icmp_seq=2 ttl=64 time=0.121 ms
64 bytes from 10.0.0.10: icmp_seq=3 ttl=64 time=0.179 ms

--- 10.0.0.10 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2041ms
rtt min/avg/max/mdev = 0.121/334.611/1003.534/472.999 ms
root@pc8:/# ping -c 3 10.0.0.22
PING 10.0.0.22 (10.0.0.22) 56(84) bytes of data:
64 bytes from 10.0.0.22: icmp_seq=1 ttl=64 time=0.189 ms
64 bytes from 10.0.0.22: icmp_seq=2 ttl=64 time=0.084 ms
64 bytes from 10.0.0.22: icmp_seq=3 ttl=64 time=0.060 ms

--- 10.0.0.22 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2041ms
rtt min/avg/max/mdev = 0.060/0.111/0.189/0.056 ms
root@pc8:/#
```

root@pc3: /

```
--- Startup Commands Log
++ ifconfig eth0 10.0.0.30/24 up
++ ifconfig eth0 hw ether 00:00:00:00:77:30
--- End Startup Commands Log
root@pc3:/# ping -c 3 10.0.0.40
PING 10.0.0.40 (10.0.0.40) 56(84) bytes of data:
64 bytes from 10.0.0.40: icmp_seq=1 ttl=64 time=0.178 ms
64 bytes from 10.0.0.40: icmp_seq=2 ttl=64 time=0.145 ms
64 bytes from 10.0.0.40: icmp_seq=3 ttl=64 time=0.200 ms

--- 10.0.0.40 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2041ms
rtt min/avg/max/mdev = 0.145/0.174/0.200/0.022 ms
root@pc3:/# ping -c 3 10.0.0.33
PING 10.0.0.33 (10.0.0.33) 56(84) bytes of data:
64 bytes from 10.0.0.33: icmp_seq=1 ttl=64 time=0.191 ms
64 bytes from 10.0.0.33: icmp_seq=2 ttl=64 time=0.202 ms
64 bytes from 10.0.0.33: icmp_seq=3 ttl=64 time=0.196 ms

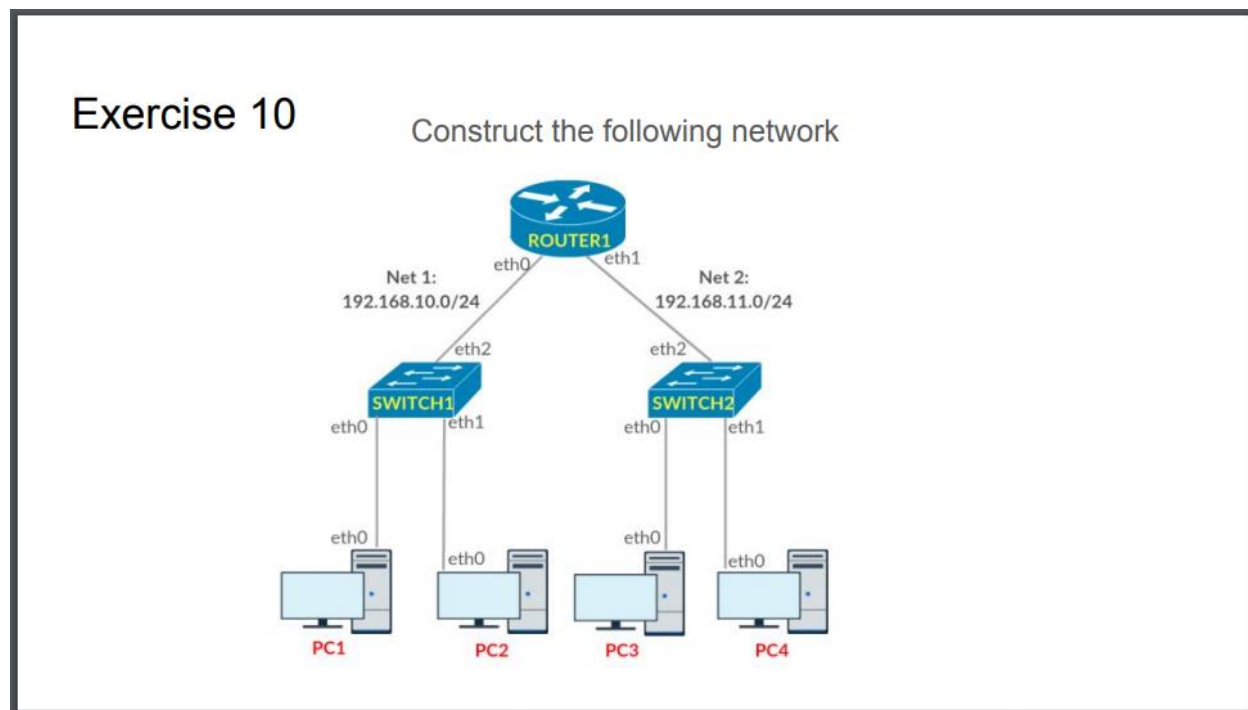
--- 10.0.0.33 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2025ms
rtt min/avg/max/mdev = 0.191/0.196/0.202/0.004 ms
root@pc3:/#
```

```

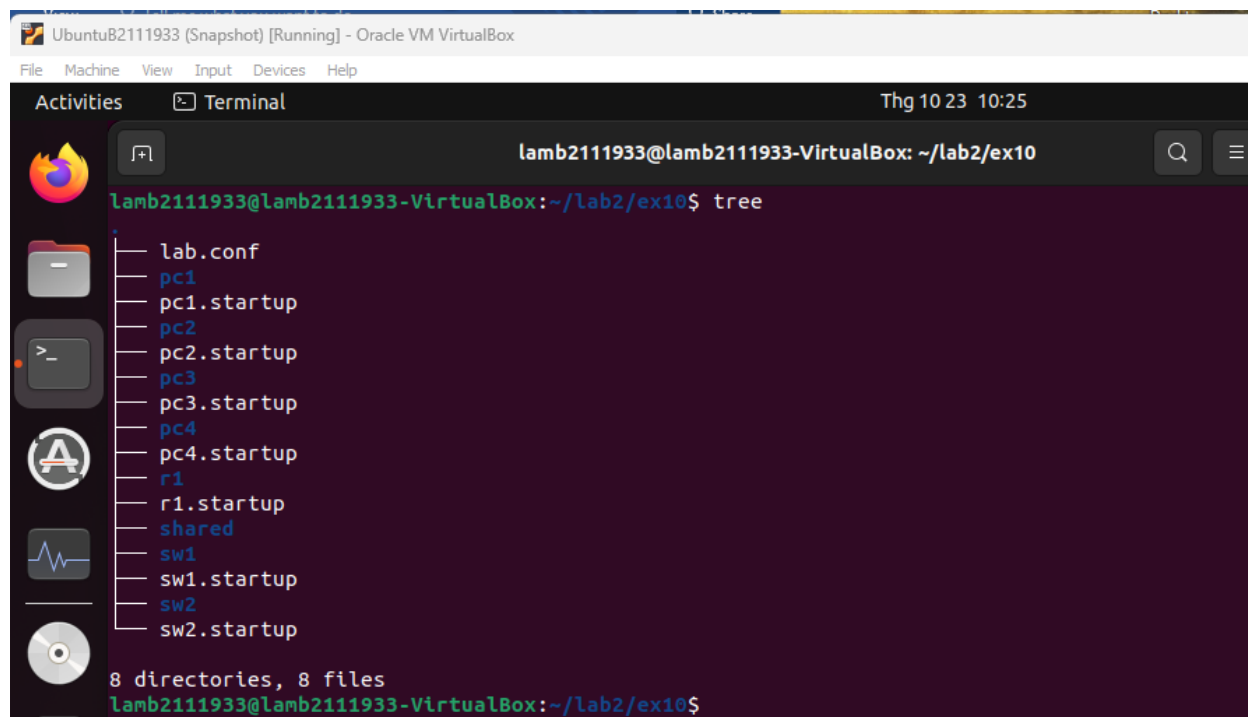
UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities XTerm Thg 10 23 09:56
root@sw1: /
root@sw1:~# brctl showmacs br0
port no mac addr is local? ageing timer
1 00:00:00:00:00:10 no 109.10
3 00:00:00:00:00:30 no 42.02
4 00:00:00:00:00:40 no 46.89
5 00:00:00:00:77:30 no 42.02
5 00:00:00:00:77:40 no 97.28
1 00:00:00:10:10:2f yes 0.00
1 00:00:00:10:10:2f yes 0.00
2 00:00:00:20:20:00 yes 0.00
2 00:00:00:20:20:00 yes 0.00
3 00:00:00:30:30:00 yes 0.00
3 00:00:00:30:30:00 yes 0.00
4 00:00:00:40:40:00 yes 0.00
4 00:00:00:40:40:00 yes 0.00
5 00:00:00:50:50:00 yes 0.00
5 00:00:00:50:50:00 yes 0.00
5 00:00:00:88:50:00 no 1.10
5 06:5d:5c:5c:04:70 no 17.20
2 22:c0:f9:38:bc:36 no 10.79
2 36:06:1d:d9:9c:2b no 23.18
5 36:90:5f:c6:97:9a no 6.70
1 4e:96:ee:b7:e2:65 no 17.14
3 62:fa:91:1d:3f:5a no 16.82

```

Exercise 10



Create folders and files

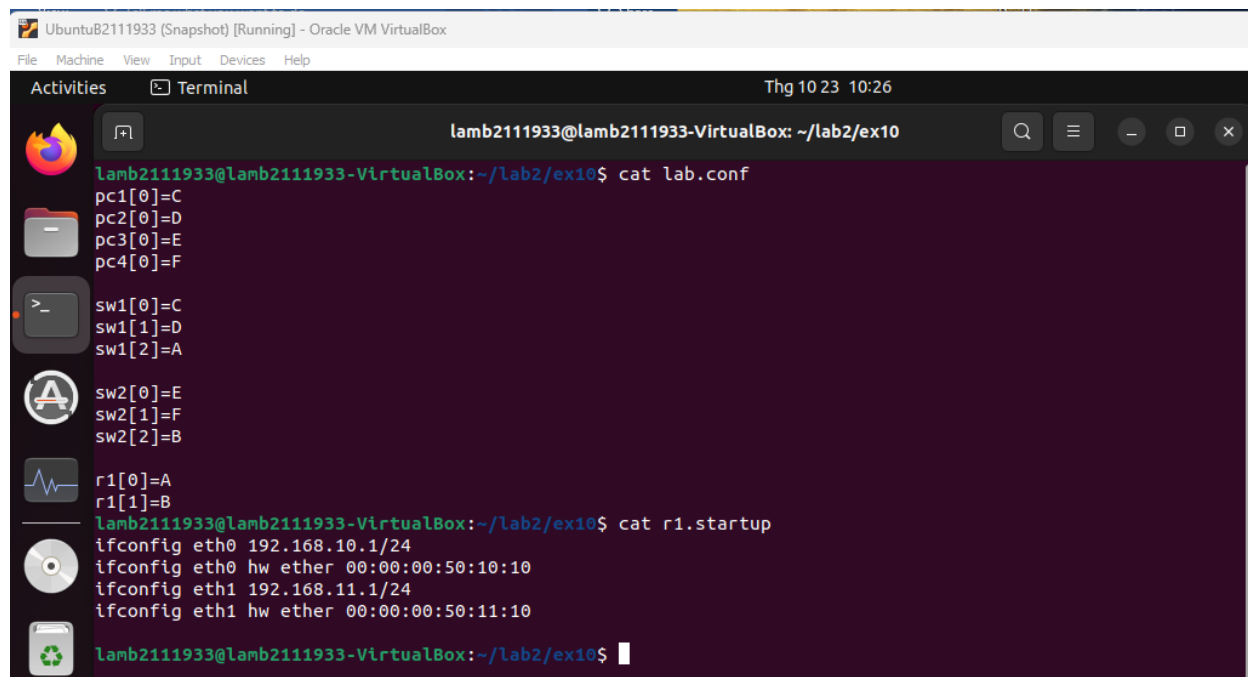


The screenshot shows a terminal window titled "UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox". The terminal prompt is "lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex10". The user has entered the command "tree", and the output shows a directory structure with 8 directories and 8 files. The files are: lab.conf, pc1, pc1.startup, pc2, pc2.startup, pc3, pc3.startup, pc4, pc4.startup, r1, r1.startup, shared, sw1, sw1.startup, sw2, and sw2.startup. The terminal also shows the command "cat lab.conf" and its output.

```
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex10$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── pc4
├── pc4.startup
├── r1
├── r1.startup
├── shared
├── sw1
├── sw1.startup
├── sw2
└── sw2.startup

8 directories, 8 files
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex10$
```

The contents of files:



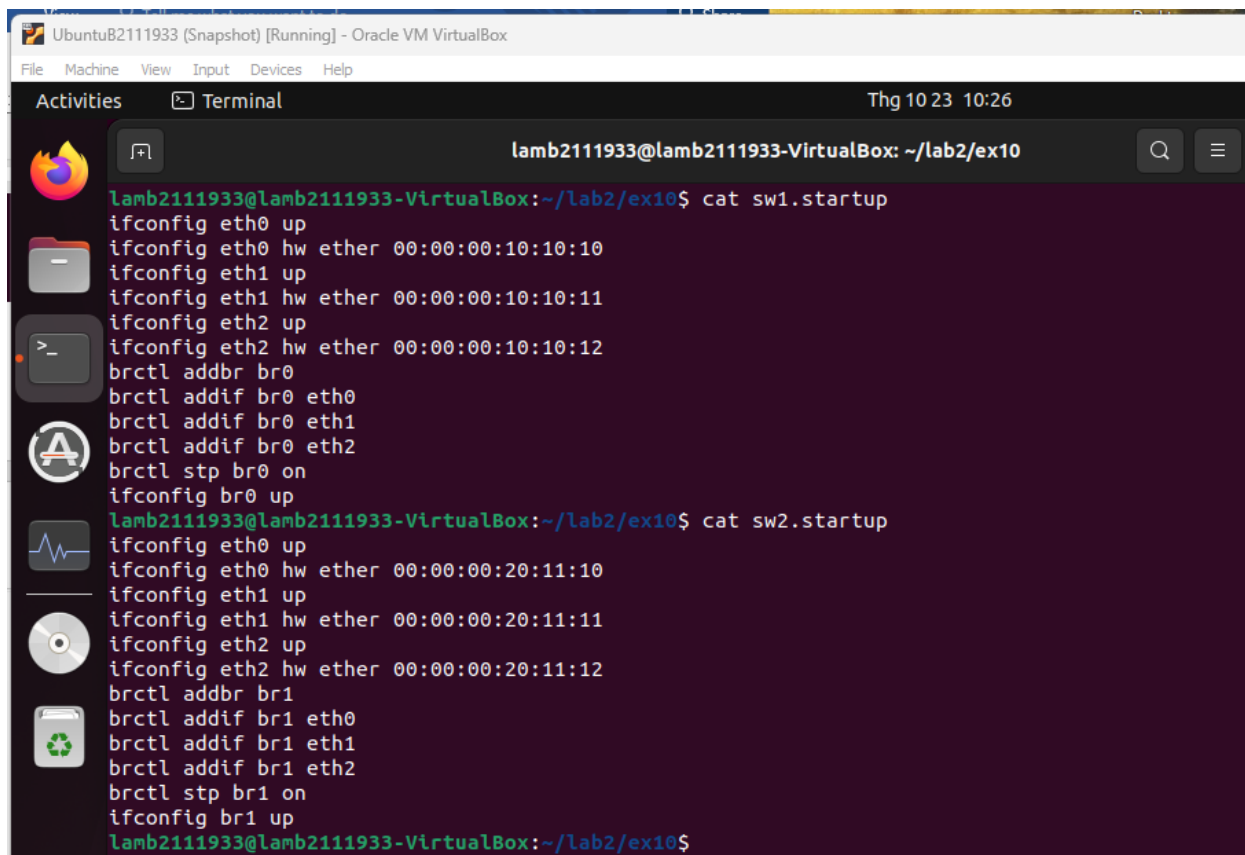
The screenshot shows a terminal window titled "UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox". The terminal prompt is "lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex10". The user has entered the command "cat lab.conf", and the output shows the contents of the file. The user has also entered the command "cat r1.startup", and the output shows the contents of the file.

```
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex10$ cat lab.conf
pc1[0]=C
pc2[0]=D
pc3[0]=E
pc4[0]=F

sw1[0]=C
sw1[1]=D
sw1[2]=A

sw2[0]=E
sw2[1]=F
sw2[2]=B

r1[0]=A
r1[1]=B
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex10$ cat r1.startup
ifconfig eth0 192.168.10.1/24
ifconfig eth0 hw ether 00:00:00:50:10:10
ifconfig eth1 192.168.11.1/24
ifconfig eth1 hw ether 00:00:00:50:11:10
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex10$
```



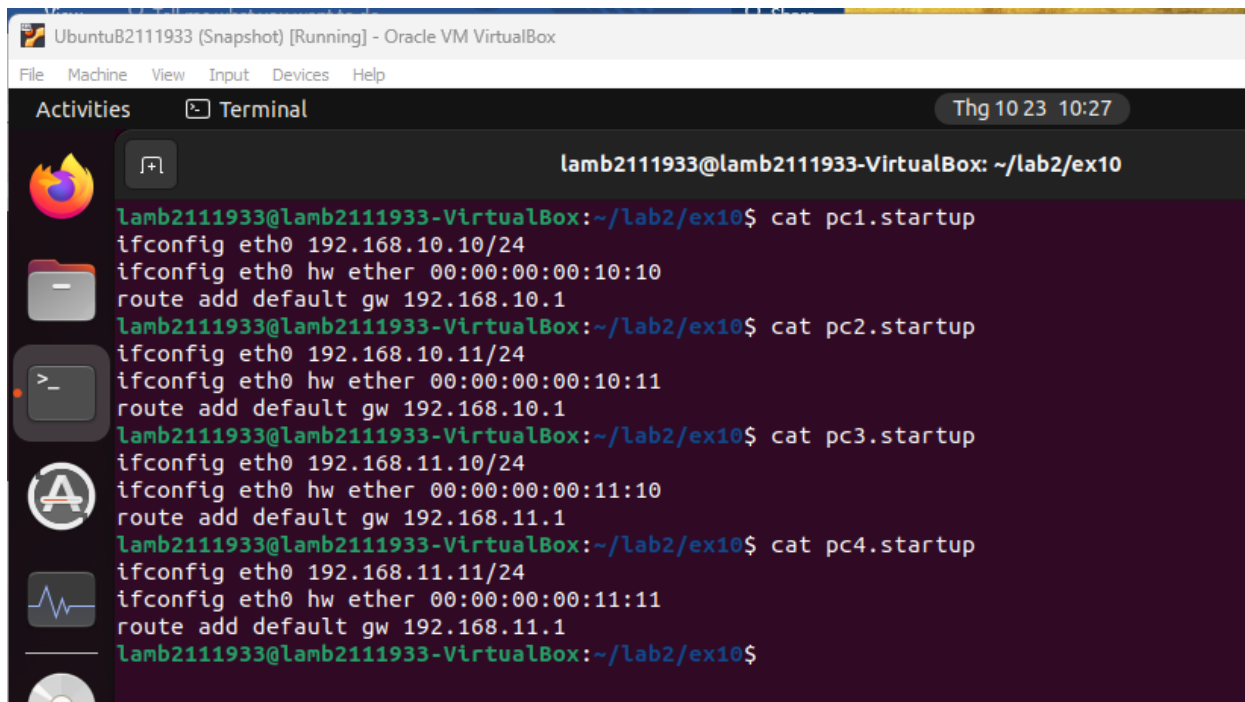
UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Thg 10 23 10:26

lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex10

```
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex10$ cat sw1.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:10:10:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:10:10:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:10:10:12
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl stp br0 on
ifconfig br0 up
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex10$ cat sw2.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:20:11:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:20:11:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:20:11:12
brctl addbr br1
brctl addif br1 eth0
brctl addif br1 eth1
brctl addif br1 eth2
brctl stp br1 on
ifconfig br1 up
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex10$
```



UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

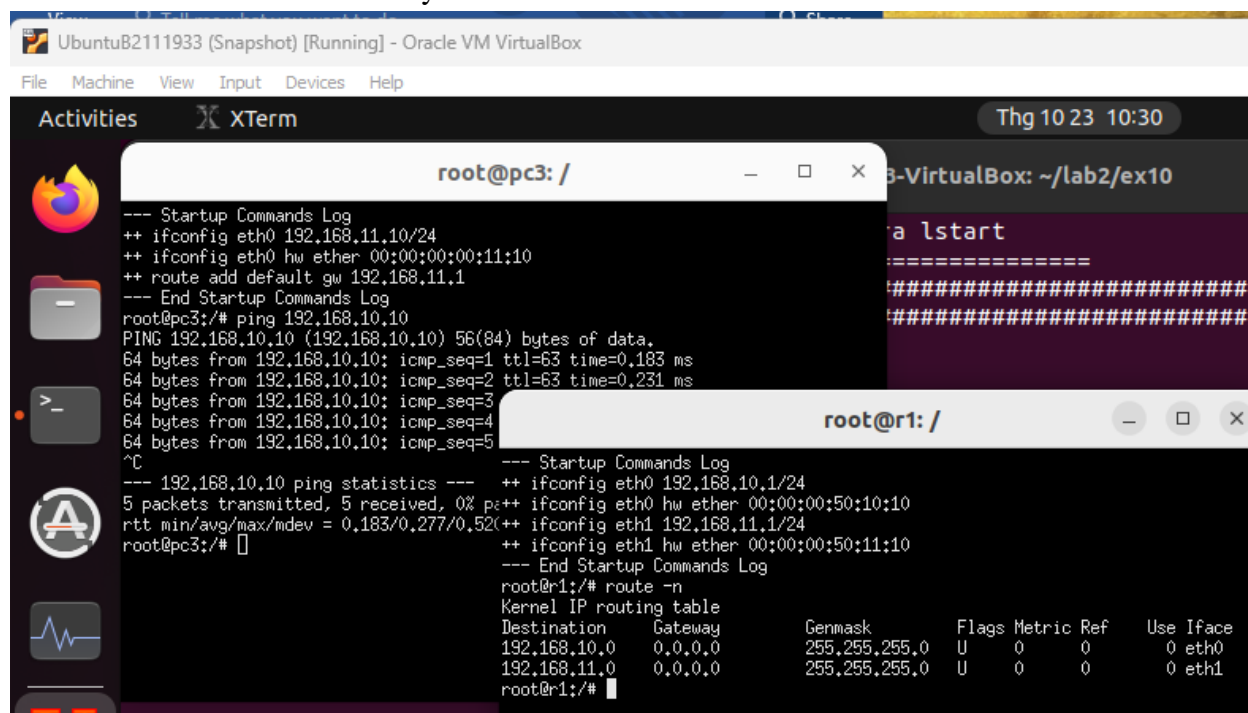
File Machine View Input Devices Help

Activities Terminal Thg 10 23 10:27

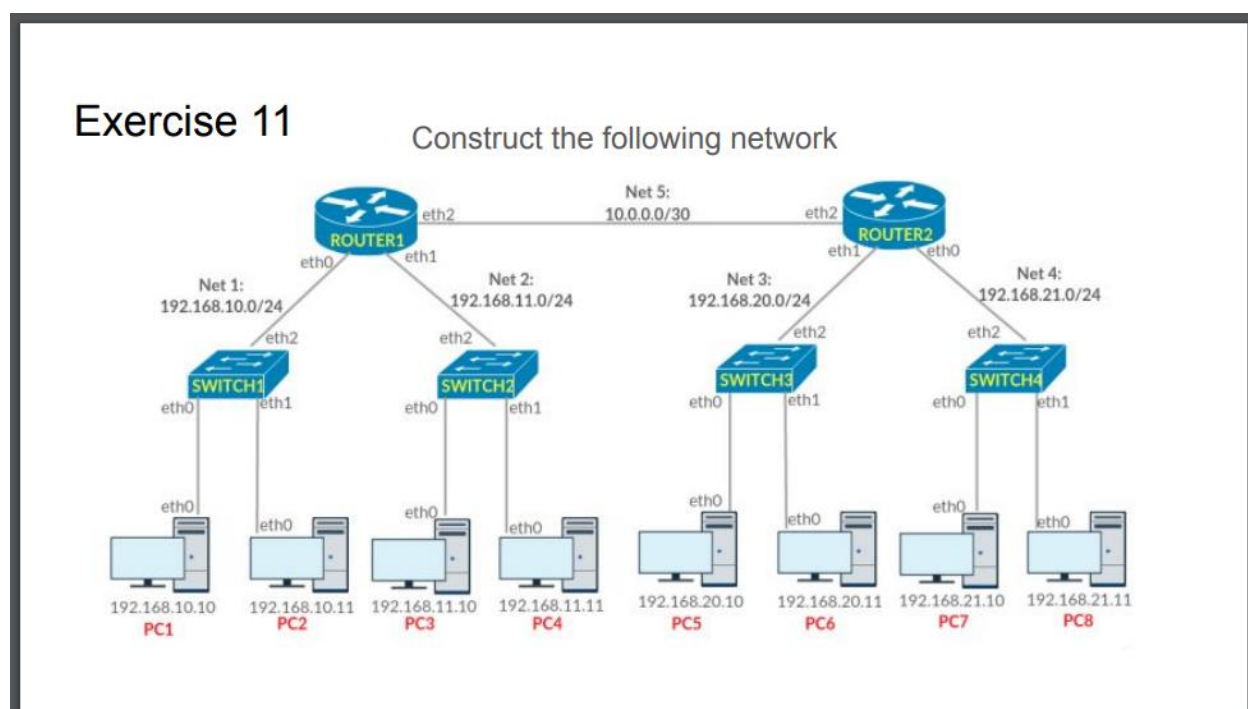
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex10

```
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex10$ cat pc1.startup
ifconfig eth0 192.168.10.10/24
ifconfig eth0 hw ether 00:00:00:00:10:10
route add default gw 192.168.10.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex10$ cat pc2.startup
ifconfig eth0 192.168.10.11/24
ifconfig eth0 hw ether 00:00:00:00:10:11
route add default gw 192.168.10.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex10$ cat pc3.startup
ifconfig eth0 192.168.11.10/24
ifconfig eth0 hw ether 00:00:00:00:11:10
route add default gw 192.168.11.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex10$ cat pc4.startup
ifconfig eth0 192.168.11.11/24
ifconfig eth0 hw ether 00:00:00:00:11:11
route add default gw 192.168.11.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex10$
```

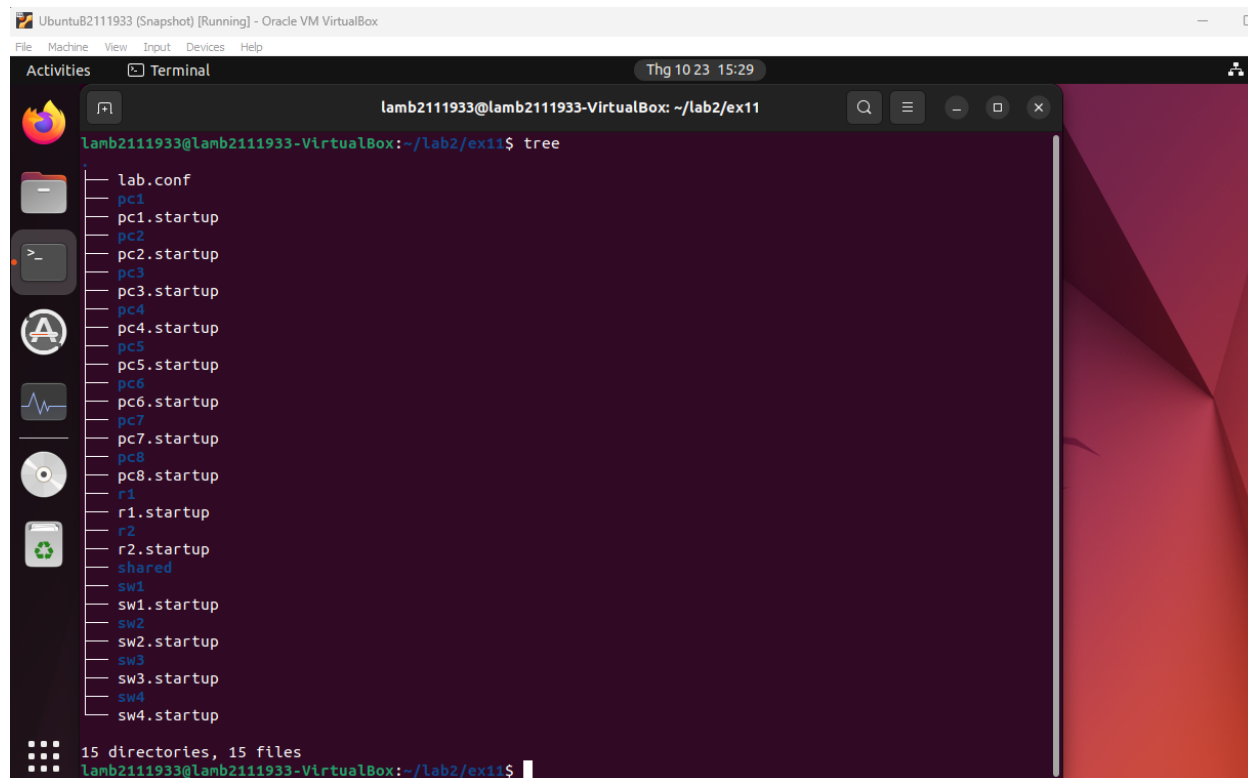
Start the lab and test connectivity



Exercise 11



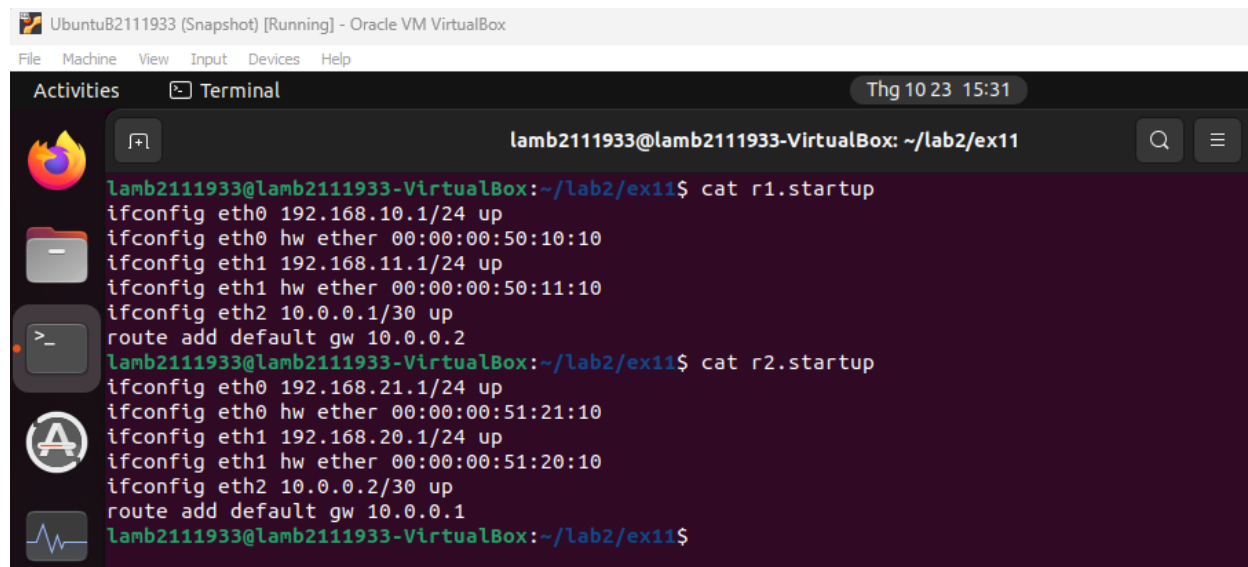
Create files and folders



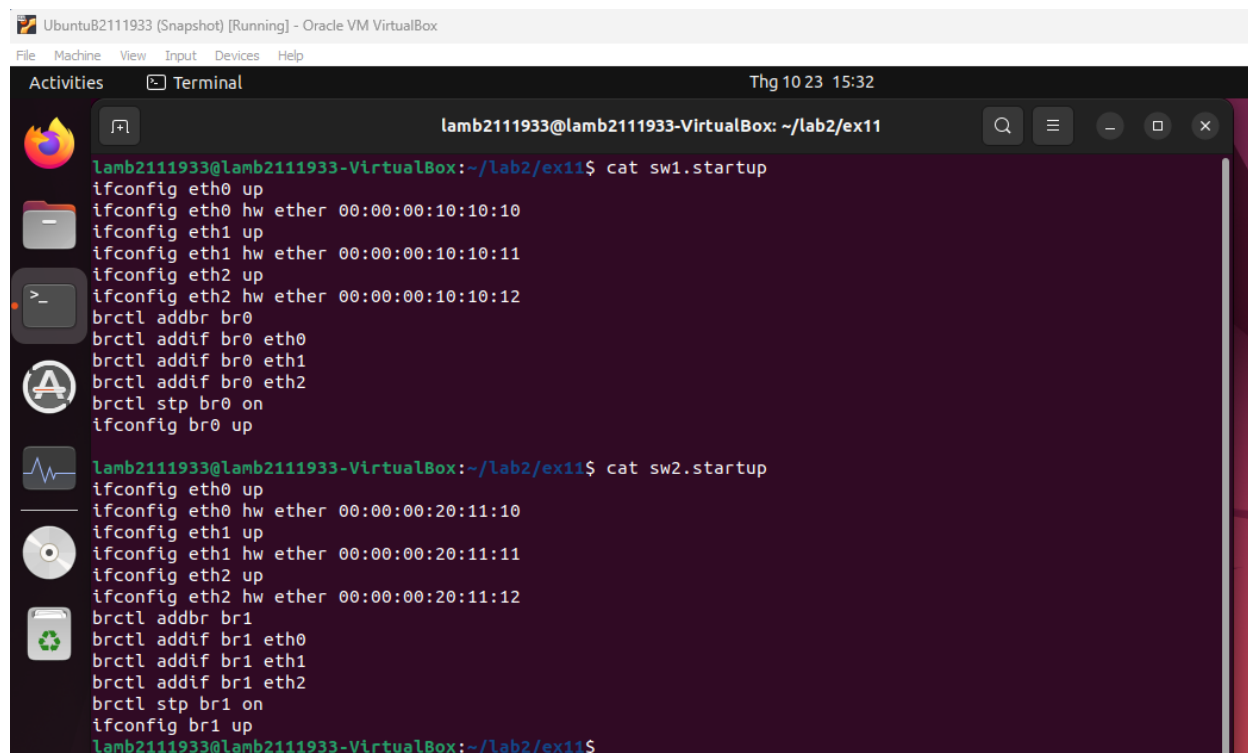
```
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex11$ tree
.
├── lab.conf
├── pc1
│   ├── pc1.startup
│   ├── pc2
│   │   ├── pc2.startup
│   │   ├── pc3
│   │   │   ├── pc3.startup
│   │   │   ├── pc4
│   │   │   │   ├── pc4.startup
│   │   │   │   ├── pc5
│   │   │   │   │   ├── pc5.startup
│   │   │   │   │   ├── pc6
│   │   │   │   │   │   ├── pc6.startup
│   │   │   │   │   │   ├── pc7
│   │   │   │   │   │   │   ├── pc7.startup
│   │   │   │   │   │   │   ├── pc8
│   │   │   │   │   │   │   │   ├── pc8.startup
│   │   │   │   │   │   │   │   ├── r1
│   │   │   │   │   │   │   │   │   ├── r1.startup
│   │   │   │   │   │   │   │   │   ├── r2
│   │   │   │   │   │   │   │   │   │   ├── r2.startup
│   │   │   │   │   │   │   │   │   │   ├── shared
│   │   │   │   │   │   │   │   │   │   ├── sw1
│   │   │   │   │   │   │   │   │   │   │   ├── sw1.startup
│   │   │   │   │   │   │   │   │   │   │   ├── sw2
│   │   │   │   │   │   │   │   │   │   │   │   ├── sw2.startup
│   │   │   │   │   │   │   │   │   │   │   │   ├── sw3
│   │   │   │   │   │   │   │   │   │   │   │   │   ├── sw3.startup
│   │   │   │   │   │   │   │   │   │   │   │   │   ├── sw4
│   │   │   │   │   │   │   │   │   │   │   │   │   │   ├── sw4.startup
├── r1
├── r1.startup
├── r2
├── r2.startup
├── shared
├── sw1
├── sw1.startup
├── sw2
├── sw2.startup
├── sw3
├── sw3.startup
├── sw4
└── sw4.startup

15 directories, 15 files
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex11$
```

The contents of files:



```
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex11$ cat r1.startup
ifconfig eth0 192.168.10.1/24 up
ifconfig eth0 hw ether 00:00:00:50:10:10
ifconfig eth1 192.168.11.1/24 up
ifconfig eth1 hw ether 00:00:00:50:11:10
ifconfig eth2 10.0.0.1/30 up
route add default gw 10.0.0.2
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex11$ cat r2.startup
ifconfig eth0 192.168.21.1/24 up
ifconfig eth0 hw ether 00:00:00:51:21:10
ifconfig eth1 192.168.20.1/24 up
ifconfig eth1 hw ether 00:00:00:51:20:10
ifconfig eth2 10.0.0.2/30 up
route add default gw 10.0.0.1
lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex11$
```



UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

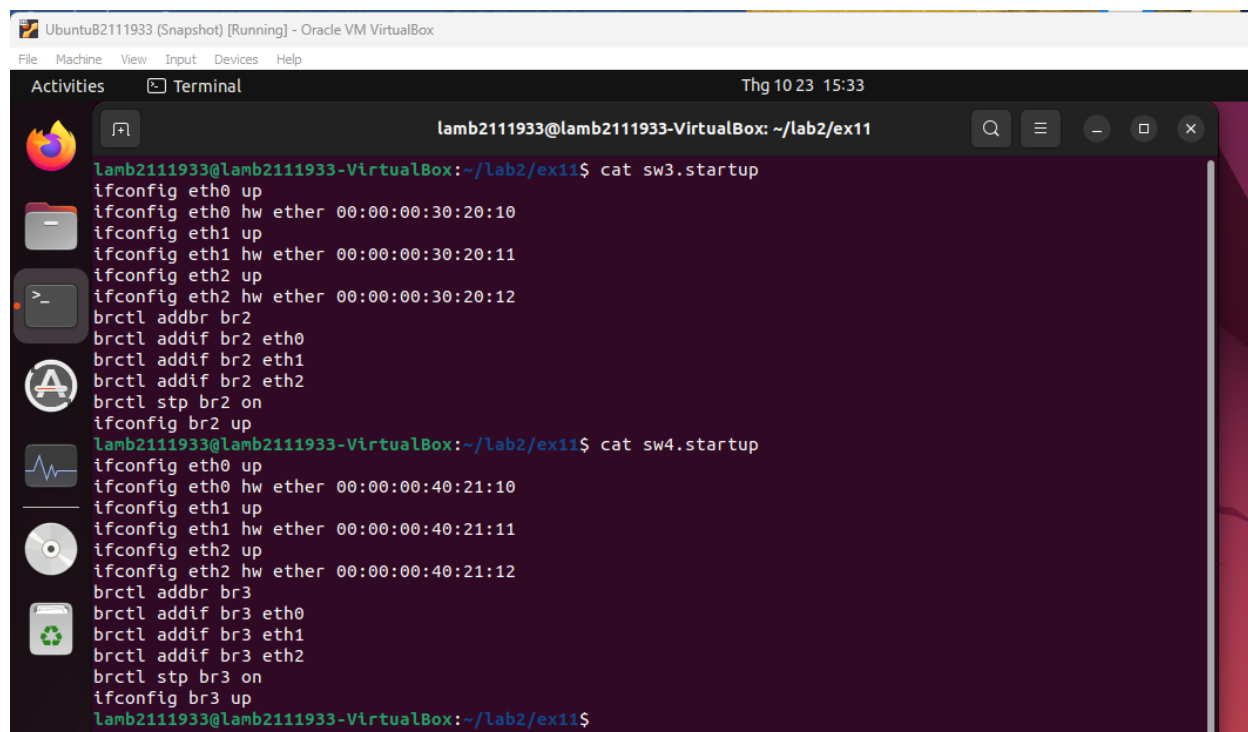
File Machine View Input Devices Help

Activities Terminal Thg 10 23 15:32

lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex11

```
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$ cat sw1.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:10:10:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:10:10:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:10:10:12
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl stp br0 on
ifconfig br0 up

lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$ cat sw2.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:20:11:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:20:11:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:20:11:12
brctl addbr br1
brctl addif br1 eth0
brctl addif br1 eth1
brctl addif br1 eth2
brctl stp br1 on
ifconfig br1 up
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$
```



UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

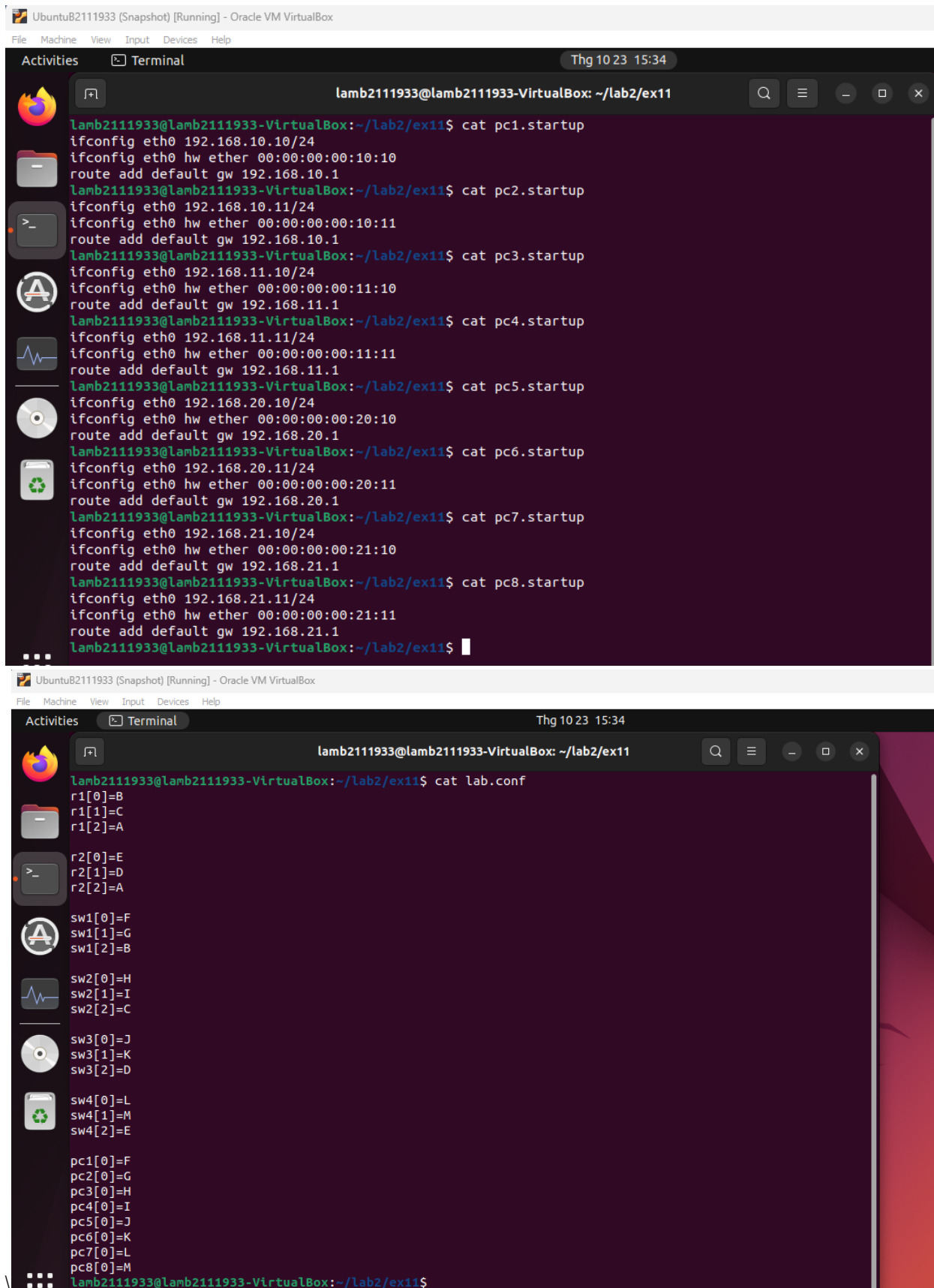
File Machine View Input Devices Help

Activities Terminal Thg 10 23 15:33

lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex11

```
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$ cat sw3.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:30:20:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:30:20:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:30:20:12
brctl addbr br2
brctl addif br2 eth0
brctl addif br2 eth1
brctl addif br2 eth2
brctl stp br2 on
ifconfig br2 up

lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$ cat sw4.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:40:21:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:40:21:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:40:21:12
brctl addbr br3
brctl addif br3 eth0
brctl addif br3 eth1
brctl addif br3 eth2
brctl stp br3 on
ifconfig br3 up
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$
```



UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Thg 10 23 15:34

lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex11

```
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$ cat pc1.startup
ifconfig eth0 192.168.10.10/24
ifconfig eth0 hw ether 00:00:00:00:10:10
route add default gw 192.168.10.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$ cat pc2.startup
ifconfig eth0 192.168.10.11/24
ifconfig eth0 hw ether 00:00:00:00:10:11
route add default gw 192.168.10.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$ cat pc3.startup
ifconfig eth0 192.168.11.10/24
ifconfig eth0 hw ether 00:00:00:00:11:10
route add default gw 192.168.11.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$ cat pc4.startup
ifconfig eth0 192.168.11.11/24
ifconfig eth0 hw ether 00:00:00:00:11:11
route add default gw 192.168.11.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$ cat pc5.startup
ifconfig eth0 192.168.20.10/24
ifconfig eth0 hw ether 00:00:00:00:20:10
route add default gw 192.168.20.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$ cat pc6.startup
ifconfig eth0 192.168.20.11/24
ifconfig eth0 hw ether 00:00:00:00:20:11
route add default gw 192.168.20.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$ cat pc7.startup
ifconfig eth0 192.168.21.10/24
ifconfig eth0 hw ether 00:00:00:00:21:10
route add default gw 192.168.21.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$ cat pc8.startup
ifconfig eth0 192.168.21.11/24
ifconfig eth0 hw ether 00:00:00:00:21:11
route add default gw 192.168.21.1
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$
```

UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Thg 10 23 15:34

lamb2111933@lamb2111933-VirtualBox: ~/lab2/ex11

```
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$ cat lab.conf
r1[0]=B
r1[1]=C
r1[2]=A

r2[0]=E
r2[1]=D
r2[2]=A

sw1[0]=F
sw1[1]=G
sw1[2]=B

sw2[0]=H
sw2[1]=I
sw2[2]=C

sw3[0]=J
sw3[1]=K
sw3[2]=D

sw4[0]=L
sw4[1]=M
sw4[2]=E

pc1[0]=F
pc2[0]=G
pc3[0]=H
pc4[0]=I
pc5[0]=J
pc6[0]=K
pc7[0]=L
pc8[0]=M
lamb2111933@lamb2111933-VirtualBox:~/lab2/ex11$
```

Start the lab and test connectivity

```
UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

Activities XTerm Thg 10 23 15:37

root@r1: /
--- Startup Commands Log
++ ifconfig eth0 192.168.10.1/24 up
++ ifconfig eth0 hw ether 00:00:00:50:10:10
++ ifconfig eth1 192.168.11.1/24 up
++ ifconfig eth1 hw ether 00:00:00:50:11:10
++ ifconfig eth2 10.0.0.1/30 up
++ route add default gw 10.0.0.2
--- End Startup Commands Log
root@r1:/# route -n
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
0.0.0.0 10.0.0.2 0.0.0.0 UG 0 0 0 eth2
10.0.0.0 0.0.0.0 255.255.255.252 U 0 0 0 eth2
192.168.10.0 0.0.0.0 255.255.255.0 U 0 0 0 eth0
192.168.11.0 0.0.0.0 255.255.255.0 U 0 0 0 eth1
root@r1:/#

root@r2: /
--- Startup Commands Log
++ ifconfig eth0 192.168.21.1/24 up
++ ifconfig eth0 hw ether 00:00:00:51:21:10
++ ifconfig eth1 192.168.20.1/24 up
++ ifconfig eth1 hw ether 00:00:00:51:20:10
++ ifconfig eth2 10.0.0.2/30 up
++ route add default gw 10.0.0.1
--- End Startup Commands Log
root@r2:/# route -n
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
0.0.0.0 10.0.0.1 0.0.0.0 UG 0 0 0 eth2
10.0.0.0 0.0.0.0 255.255.255.252 U 0 0 0 eth2
192.168.20.0 0.0.0.0 255.255.255.0 U 0 0 0 eth1
192.168.21.0 0.0.0.0 255.255.255.0 U 0 0 0 eth0
root@r2:/#
```

```
UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

Activities XTerm Thg 10 23 15:43

root@pc1: /
--- Startup Commands Log
++ ifconfig eth0 192.168.10.10/24
++ ifconfig eth0 hw ether 00:00:00:00:10:10
++ route add default gw 192.168.10.1
--- End Startup Commands Log
root@pc1:/# ping -c 3 192.168.21.11
PING 192.168.21.11 (192.168.21.11) 56(84) bytes of data:
64 bytes from 192.168.21.11: icmp_seq=1 ttl=62 time=0.209 ms
64 bytes from 192.168.21.11: icmp_seq=2 ttl=62 time=0.241 ms
64 bytes from 192.168.21.11: icmp_seq=3 ttl=62 time=0.233 ms
--- 192.168.21.11 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2035ms
rtt min/avg/max/mdev = 0.088/0.189/0.244/0.071 ms
root@pc1:/# ping -c 3 192.168.11.11
PING 192.168.11.11 (192.168.11.11) 56(84) bytes of data:
64 bytes from 192.168.11.11: icmp_seq=1 ttl=63 time=0.188 ms
64 bytes from 192.168.11.11: icmp_seq=2 ttl=63 time=0.241 ms
64 bytes from 192.168.11.11: icmp_seq=3 ttl=63 time=0.252 ms
--- 192.168.11.11 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2035ms
rtt min/avg/max/mdev = 0.151/0.206/0.236/0.039 ms
root@pc1:/#

root@pc5: /
--- Startup Commands Log
++ ifconfig eth0 192.168.20.10/24
++ ifconfig eth0 hw ether 00:00:00:00:20:10
++ route add default gw 192.168.20.1
--- End Startup Commands Log
root@pc5:/# ping -c 3 192.168.11.10
PING 192.168.11.10 (192.168.11.10) 56(84) bytes of data:
64 bytes from 192.168.11.10: icmp_seq=1 ttl=62 time=0.209 ms
64 bytes from 192.168.11.10: icmp_seq=2 ttl=62 time=0.265 ms
64 bytes from 192.168.11.10: icmp_seq=3 ttl=62 time=0.233 ms
--- 192.168.11.10 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2035ms
rtt min/avg/max/mdev = 0.209/0.235/0.265/0.022 ms
root@pc5:/# ping -c 3 192.168.21.10
PING 192.168.21.10 (192.168.21.10) 56(84) bytes of data:
64 bytes from 192.168.21.10: icmp_seq=1 ttl=63 time=0.188 ms
64 bytes from 192.168.21.10: icmp_seq=2 ttl=63 time=0.241 ms
64 bytes from 192.168.21.10: icmp_seq=3 ttl=63 time=0.252 ms
--- 192.168.21.10 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2035ms
rtt min/avg/max/mdev = 0.188/0.227/0.252/0.027 ms
root@pc5:/#
```